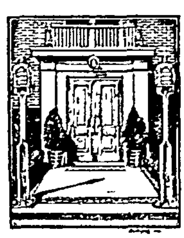
COMPTON'S PICTURED ENCYCLOPEDIA AND FACT-INDEX

Interesting · Accurate · Up-to-date

TO INSPIRE AMBITION,
TO STIMULATE THE IMAGINATION, TO PROVIDE THE
INQUIRING MIND WITH ACCURATE
INFORMATION TOLD IN AN INTERESTING
STYLE, AND THUS LEAD INTO
BROADER FIELDS OF KNOWLEDGE,
SUCH IS THE PURPOSE OF
THIS WORK



Volume 9

1956 Edition

PUBLISHED BY
F. E. COMPTON & COMPANY · CHICAGO

1956 EDITION

COMPTON'S PICTURED ENCYCLOPEDIA

LIBRARY OF CONGRESS CATALOG CARD NUMBER: 55-9384

Here and There in This Volume

At odd times when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. With this as a guide, you may visit faraway countries and watch people at their work and play, meet famous persons of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list is not intended to serve as a table of contents, an index, or a study guide. For these purposes consult the Fact-Index and the Reference-Outlines.

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KEY TO PRONUNCIATION

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index. Marked letters are sounded as in the following words: *cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre;* īce, bĭt; rōw, wȯn, fôr, nŏt, dö; cūre, bŭt, rüde, fụll, bûrn; *out*; *ü*=French *u*, German *ü*; *ġem*, *ḡo*; *th*in, *th*en; *ṅ*=French nasal (Jeaṅ); *zh*= French *j* (*z* in azure); *K*=German guttural *ch*.

M

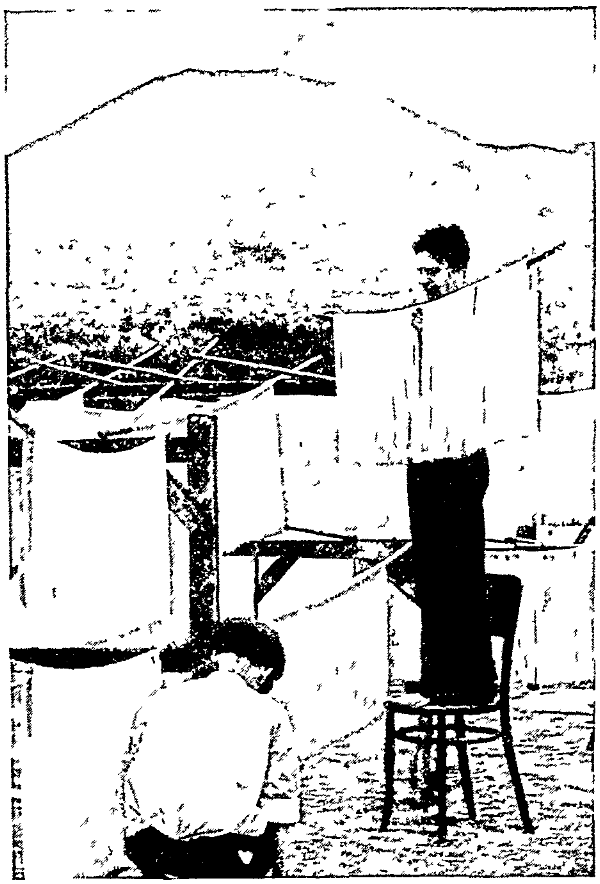
MACARONI AND SPAGHETTI. Flour does not keep well, particularly in warm climates. But if it is made into paste and then shaped in thin strips that can be dried thoroughly, it keeps indefinitely. These paste products are known by various names according to their form: macaroni (tubes), spaghetti (sticks), vermicelli (threads), noodles (ribbons), and fancy pastes (small pieces in various shapes). These preparations are inexpensive and easily cooked and combine readily with other foods to make savory and nourishing dishes and soups.

Macaroni and its relatives are made of the type of wheat called "hard" (*see* Wheat). These are rich in gluten, the gummy substance that holds the paste together. Durum, one of the hardest wheats, is grown especially for this purpose. The entire wheat kernel is ground up into a coarse flour called *semolina*, which is made into paste with boiling water. The paste is then put into a press and forced through holes in a perforated plate. Spaghetti and vermicelli are passed through round holes, noodles through small slits, and macaroni through a tube with a pin forming a central core. The paste is partially cooked as it passes through the press. It comes out in continuous strands, which are cut up and placed in a cabinet for drying. For fancy pastes the mixture goes through perforations in the shape of letters, animals, or stars, and is then sheared off in thin slices.

Macaroni and its relatives should be yellowish in color with a somewhat rough surface, showing a few bran specks. In boiling they should swell to double the original size without becoming sticky or pasty. Noodles are made of patent flour (*see* Flour and Flour Milling). When labeled "egg noodles" they must contain some egg solids.

The Italians are credited with inventing macaroni in the 13th century, though rice paste had long been known in China. Italy, with an average of 50 pounds a year a person, eats the most macaroni. The United States is second.

DRIED BY THE HOT ITALIAN SUN



Vesuvius smokes in the background as these Neapolitan spaghetti makers hang the long strands on poles to dry. American manufacturers dry their product in special cabinets, through which purified air is pumped.

MacARTHUR, DOUGLAS (born 1880). In the dark days of 1941–42, following Japan's attack on Pearl Harbor and the United States entry into war, the name of Gen. Douglas MacArthur became to the world a symbol of American resolve, grit, and fighting ability.

Under his command the 12,000 American and 35,000 Filipino troops besieged on Bataan peninsula west of Manila beat back week after week many times their number of Japanese soldiers. Though they lacked air support and were cut off from supplies and reinforcements, MacArthur's men were not content with defensive action alone. Again and again they boldly struck, and so demoralized the armies of the Japanese that their first commanding general was believed to have killed himself.

While the enemy was capturing Hong Kong, sweeping down the Malay Peninsula, taking Singapore, and overwhelming the East Indies, MacArthur stood firm. So notable was his work that when an invasion of Australia was threatened, the Australian press joined in a demand that the hero of Bataan be ordered out of the Philippine trap to take command of all the United Nations forces in the southwest Pacific.

Accordingly, President Roosevelt on Feb. 22, 1942, sent secret orders to MacArthur to break out through the Japanese lines as soon as possible and report for duty in Australia. On the night of March 11, after transferring his command in the Philippines to Gen. Jonathan M. Wainwright, MacArthur and his wife and four-year-old son and members of his staff ran the Japanese blockade in torpedo boats and made their way to Australia. "I shall return," he promised the Filipinos. Brilliant military and naval campaigns in the South Pacific enabled him to keep that promise. On Oct. 20, 1944, he landed with his forces on Leyte Island. As commander in chief in the Pacific he accepted Japan's surrender Sept. 2, 1945. He then directed the occupation of Japan. (*See also* Japan; World War,

Second). At the outbreak of war in Korea in 1950 he became commander of the United Nations forces. In 1951 he urged opening a "second front" on Red China. Calling him "out of sympathy" with national policy, Truman relieved him of all commands April 11. He and his family made a triumphal return to the United States. In a speech before Congress he accused the administration of not wanting to win the war. Retiring from active service he became a corporation chairman. In 1952 he gave the keynote speech at the Republican convention, and in April 1953 he urged attack on Red China's industrial bases to end the war.

Douglas MacArthur was born on Jan. 26, 1880, on an army reservation at Little Rock, Ark. His father was Gen. Arthur MacArthur, who served with distinction in the Civil War and the Spanish-American War and was military governor of the Philippines under President McKinley. At West Point young MacArthur was graduated in 1903 with the highest scholastic record achieved by any cadet in 25 years. When the United States entered the first World War, he helped to organize the Rainbow Division and went to France as its chief of staff. In battle he was usually up on the firing line and he was twice wounded in action. The end of the war found him at the head of the Rainbow Division, the youngest divisional commander in the army. The next year, at the age of 39, he was made superintendent at West Point, again the youngest on record. At 50, he was made chief of staff of the army by President Hoover, and he became the youngest full general in American history.


DOUGLAS MacARTHUR

For the next five years he fought with little success to get the army mechanized. His next assignment was to organize the defense of the Philippines in preparation for their promised independence. In 1937 he retired from the service, but continued his work in the Philippines under President Manuel Quezon, who gave him the rank of field marshal. In July 1941 he was recalled to active service as commander of United States forces in the Far East. He trained them intensively in the few months before Japan attacked. In December 1944 he was made a five-star general of the Army.

MACAULAY, THOMAS BABINGTON (1800–1859). In the 'Life and Letters of Lord Macaulay' by the English historian Trevelyan is found the following letter from Macaulay to his little niece Margaret:

Sept. 15th, 1842

MY DEAR BABA:

Thank you very much for your very pretty letter. I am always glad to make my little girl happy and nothing pleases me so much as to see that she likes books. For when she is as old as I am, she will find that they are better than all the tarts, and cakes, and toys, and plays, and sights in the world. If anybody would make me the greatest king that ever lived, with palaces, and gardens, and fine dinners, and wine, and coaches, and beautiful clothes, and hundreds of servants, on condition that I would not read books, I would not be a king. I would rather be a poor man in a garret with plenty of books, than a king who did not love reading.

Macaulay's letter spoke the absolute truth about himself. From the time he began to read at the age of three, books were his constant companions. He learned to read Greek, Latin, French, German, Spanish, Italian, and Dutch. He was a brilliant student at Cambridge University in every subject except mathematics. He read early and late, in bed and out of doors. Indeed Trevelyan says that "the only exercise in which he can be said to have excelled was that of threading crowded streets with his eyes fixed upon a book." No wonder that his friend Sydney Smith once remarked that he was "like a book in breeches."

Macaulay's wide knowledge and his marvelous memory made him a very interesting speaker, for he never ran out of material and he was always sure of his facts. Lord Melbourne, one of his colleagues in Parliament, said of him, "I wish I were as cocksure of anything as Macaulay is of everything." The remark contains a sting, for Macaulay was never bothered by doubts of his ability.

Macaulay's father, Zachary Macaulay, was a well-known reformer whose life-long opposition to African slavery wrecked the family fortunes. His son studied law and was admitted to the bar but soon turned aside to follow the career of literature. In August 1825 appeared his essay on Milton, the first of a series which for 20 years made him and the *Edinburgh Review* famous. The world of fashion and of letters now learned that this young man could write as brilliantly as he talked.

Macaulay's gifts as a writer and speaker led him naturally into public life. In Parliament, and later in India as legal adviser to the supreme council, he showed gifts of mind that always held men's attention. In politics he was a Whig, striving for a wider voting franchise and far-reaching liberal reforms. During his lifetime the Industrial Revolution was transforming English life. Macaulay was pleased with the material progress, but he closed his eyes to what he considered necessary economic evils.

History as Fascinating as Fiction

But during all the busy years of his official life, when writing was just an occasional pleasure and source of income, Macaulay was planning a history of England to begin with the accession of James II to the throne—a history, as he said, interesting enough "to supersede the last fashionable novel upon the dressing-tables of young ladies." He began it in earnest in 1841 and in 1849 finished the first two volumes. Later volumes appeared from time to time, but the work was still uncompleted when Macaulay died, just ten years later.

Macaulay's history had an immediate success, greater, perhaps, than that achieved by any other history. It had a tremendous sale in England and the United States, and was translated into all modern languages. Macaulay had worked at it with ungrudging toil. He wrote in his diary at one time: "This is a tough chapter . . . What trouble these few pages cost me! The great object is that they may read as if they had been spoken off and seem to flow as easily as table talk." His paragraphs accomplish just what he intended. They sweep the reader along.

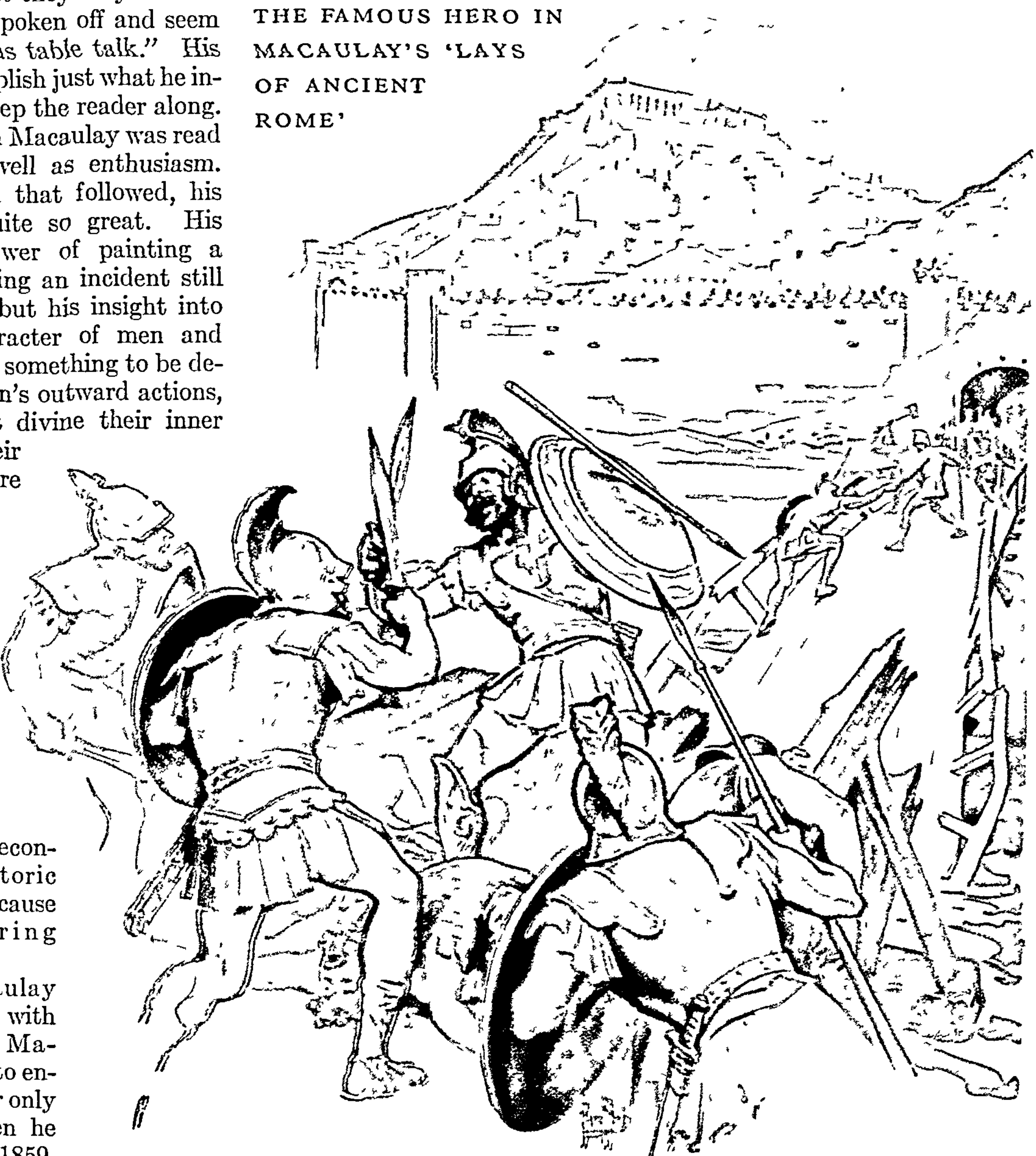
For a generation Macaulay was read with respect as well as enthusiasm. In the generation that followed, his fame was not quite so great. His brilliance, his power of painting a picture, of narrating an incident still are unsurpassed; but his insight into the complex character of men and of movements left something to be desired. He saw men's outward actions, but he could not divine their inner characters or their motives as did more sensitive writers.

Equally popular with Macaulay's essays and his history was a little volume of poems entitled 'Lays of Ancient Rome'. These still delight old and young, not merely as an exercise in the reconstruction of historic materials but because of their stirring melody.

In 1857 Macaulay was made a peer with the title Baron Macaulay. He lived to enjoy this new honor only two years. When he died, at the end of 1859, the greatest honor that England can show to her illustrious dead was conferred upon him, for he was buried in Westminster Abbey.

His principal books are: 'Critical and Historical Essays' (4 vols.); 'History of England' (5 vols.). 'The Life and Letters of Lord Macaulay' by his nephew George Otto Trevelyan is an excellent biography.

THE FAMOUS HERO IN MACAULAY'S 'LAYS OF ANCIENT ROME'



As the bridge across the Tiber starts to fall, Horatius sends his two companions back to safety. But he himself fights on, although his last means of escape appears to be cut off.

How Horatius Kept the Bridge

IN THE brave days of old—according to an ancient legend told by the Romans and retold by Macaulay in his stirring 'Lays of Ancient Rome'—the city of Rome was threatened by an invasion from the neighboring state of Etruria. A line of Etruscan kings before this time had ruled over Rome, but the last of the Tarquins, as this line was called, had been expelled, and Rome had become a republic. Now in order to re-establish their power, the Etruscan leader, Lars Porsena of Clusium, had raised a large army and was marching toward Rome, burning villages and causing the homeless people to flee in terror to the city walls.

News came that the Etruscans had taken the Janiculum, the outpost on the Tiber's farther shore and would cross the bridge into Rome. "The bridge

must straight go down," ordered the consul, but hardly had he spoken when he realized that the vanguard of the army would be upon them before this could be done.

Then up rose a brave Roman named Horatius Cocles ("the one-eyed"), who offered at the risk of his life to hold the Etruscans at bay while the Romans cut the bridge down. Two of his friends took their places by his side, while their countrymen seized their axes and smote upon the stout timbers supporting the bridge.

> Meanwhile the Tuscan army,
> Right glorious to behold,
> Came flashing back the noonday light,
> Rank behind rank, like surges bright
> Of a broad sea of gold.
> Four hundred trumpets sounded
> A peal of warlike glee,
> As that great host, with measured tread,
> And spears advanced, and ensigns spread,
> Rolled slowly toward the bridge's head,
> Where stood the dauntless Three.

Against that great host these three men stood their ground and smote one after another of the famed Etruscan leaders. Horatius himself received a blow from the boldest of them all, but "like a wildcat mad with wounds" he turned fiercely upon his assailant and slew him, striking terror into the hearts of all the foe.

And now, so well had the Romans worked at the bridge that it hung tottering over the foaming tide. "Back ere the ruin fall!" cried the fathers of the city. The two companions of Horatius darted back, but brave Horatius stood alone on the other side until the bridge fell crashing into the foaming Tiber. Then he turned toward the river with these words:

> O Tiber! Father Tiber!
> To whom the Romans pray,
> A Roman's life, a Roman's arms,
> Take thou in charge this day!

and plunged into the stream. The current was swift, for the river was swollen with months of rain. But bravely did Horatius struggle, in spite of his wound and his heavy armor, and the good Father Tiber bore him safe to shore. He was received with shouts of joy, and rewarded with land,

> As much as two strong oxen
> Could plough from morn till night.

A statue was erected to his honor in the public square and ever afterward his countrymen loved to tell the story of his heroism.

MACAW. The most brilliantly colored members of the parrot tribe are the macaws. In addition to their vivid plumage they are distinguished by a long wedge-shaped tail, long pointed wings, naked cheeks, and a short powerful bill. Adults taken into captivity are exceedingly vicious. When caught young they may grow fond of their keepers, but are still given to fits of rage at slight provocation. They do not readily learn to talk, and persist in screaming violently. There are many species, of which the red and blue macaw (*Ara macao*) and the blue and yellow macaw (*Ara ararauna*) are the most brilliantly feathered. These birds average more than 30 inches in length (*see* Parrots, Macaws, and Cockatoos).

MACBETH. This hero of Shakespeare's powerful tragedy of that name is in command of the armies of Scotland, when the play opens, and has just won a great victory over the Danes. The triumph so fires his ambition that witches, bent on evil, easily implant in his mind the thought that he should be king. Lady Macbeth still further incites him, until with his own hands he murders the Scottish king and usurps the throne. From that moment great Macbeth goes swiftly to his doom. Ghosts rise to haunt him, Lady Macbeth dies insane, civil war breaks out led by Malcolm, the son and heir of the murdered king, and finally he himself is slain in battle. Macbeth is to be abhorred for his crimes, but in all that he does and says he excites a tragic pity, as when, informed of the death of the queen, he thus gives utterance to his gloomy thoughts:

> Tomorrow, and tomorrow, and tomorrow,
> Creeps in this petty pace from day to day,
> To the last syllable of recorded time;
> And all our yesterdays have lighted fools
> The way to dusty death. Out, out, brief candle!
> Life's but a walking shadow, a poor player
> That struts and frets his hour upon the stage
> And then is heard no more: it is a tale
> Told by an idiot, full of sound and fury,
> Signifying nothing.

The story of the play is taken from history, the real Macbeth having ruled over Scotland from the year 1040 to 1057.

McCLELLAN, GEORGE BRINTON (1826–1885). General Robert E. Lee of the Confederate army once said that General McClellan was the best general ever arrayed in arms against him; and yet, after less than six months' command of a large force in the field, McClellan was removed as a failure.

He had good training. In 1846 he had graduated from West Point, and in the Mexican War he had proved so good a soldier that he had been appointed captain. In 1855 the United States government had sent him to Europe to study the war in the Crimea. At the beginning of the Civil War, in May 1861, President Lincoln had appointed him major general in the United States Army. Immediately he had been sent into West Virginia, where he had rendered valuable assistance to the loyal Unionists, who were seceding from their mother state. On account of this signal success he was hailed as "the Little Napoleon," and was called to Washington to reorganize the Army of the Potomac after its disastrous defeat at Bull Run.

His aptitude for this work was soon apparent. In a short time order and system appeared where chaos and confusion had reigned. He was a wonderful organizer and a hard worker. He won the devotion of his army, and became the idol of the hour. In November 1861 President Lincoln appointed him commander of the United States Army.

But now the fault appeared which was to overshadow all his excellent qualities. McClellan was a good organizer but a poor fighter. He had built up a wonderful military machine, but he hesitated to use it. Summer and winter passed, and still he made no move against the enemy. The patience of the

administration and of the people was sorely tried. Finally, in April 1862, under direct orders from President Lincoln, he entered upon his disastrous Peninsular Campaign, between the York and James rivers of Virginia. He advanced within a few miles of Richmond, but after a terrible week of fighting, known as the "Seven Days' battles" (June 25 to July 1), he was driven back and was directed to abandon the peninsula. Union losses in the week's battles were 15,849; Confederate, 19,749. A large part of his army was ordered to reinforce General Pope's troops, and the order was reluctantly obeyed. Pope's disastrous defeat in the second battle of Bull Run gave McClellan a new chance to retrieve his fame. Again in supreme command of the Army of the Potomac, he met Lee at Antietam, Md., where occurred one of the bloodiest battles of the war (Sept. 16–17, 1862). Lee was forced to withdraw from Maryland, but McClellan showed his old fault. Instead of driving forward at once, he allowed Lee to recross the Potomac unmolested. When he did follow, his movements were so slow that in November he was relieved of his command, and Gen. A. E. Burnside was appointed in his place.

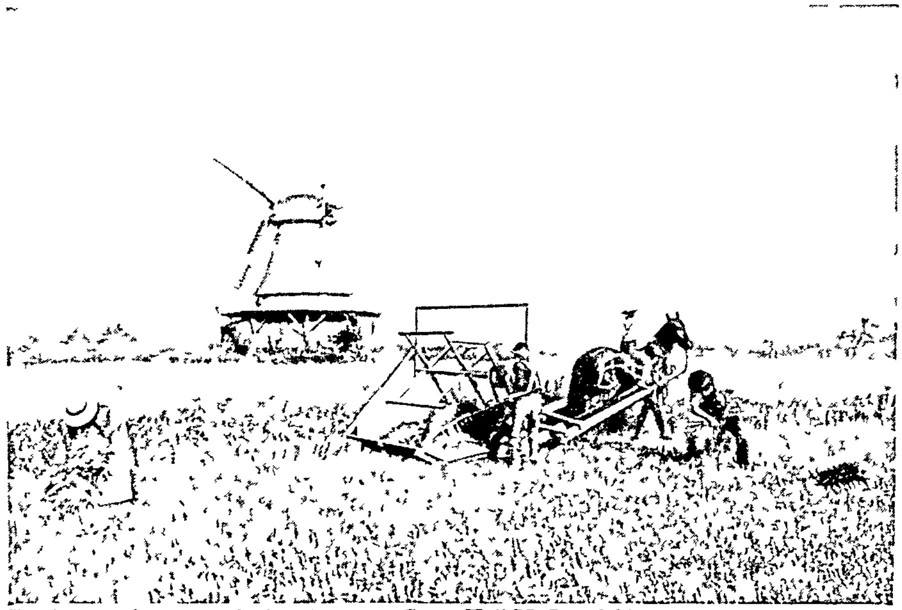
This action of Lincoln's caused much bitter criticism, for McClellan still had many devoted admirers. In the election of 1864 all who were dissatisfied with Lincoln's conduct of the war supported McClellan for president. But he carried only three states—New Jersey, Kentucky, and Delaware. McClellan had resigned his commission in the army before the election took place. The rest of his life was spent in following his profession of engineering, except for a brief term (1878–81), when he was governor of the state of New Jersey.

McCORMICK, CYRUS HALL (1809–1884). On a day in July 1831 a crowd gathered near the town of Steele's Tavern, Va. A strange-looking machine had just been pulled out on the field. It was the newly invented reaper of Cyrus Hall McCormick, a young man of 22. Doubtfully the crowd awaited the demonstration. The farm hands were among the most skeptical. Then to their amazement the machine clanked down the field cutting the grain far faster than they could do it with their cradle scythes. Although they little realized it, they were witnessing a momentous event: machinery was replacing manual labor on the farm.

Cyrus, the son of Robert and Mary Ann (Hall) McCormick, was born at "Walnut Grove," the farm of his Scottish-Irish parents, in Rockbridge County, Va. His father was a prosperous landowner, keenly interested in the mechanical side of farm life; he had invented a hemp break and for a time had experimented with a reaper. Father and son worked constantly together, and built many strange contrivances that did not always work. When his father abandoned his efforts to build a reaper, Cyrus began to work on a machine of his own. His first model was the one used in the experiment at Steele's Tavern.

For years men had been experimenting with mechanical reapers. Some inventions had already been patented in England and America. Even at this moment Obed Hussey was at work in Cincinnati on a model which he patented in 1833. Six months later, in 1834, McCormick patented his own reaper, altered to remove faults revealed by the first demonstration.

THIS IS WHAT REVOLUTIONIZED FARMING



The herald of a new agricultural era was Cyrus Hall McCormick's reaper, invented in 1831. Two men were required for its operation, one to ride the horse, and one to rake the platform. A crew of four or five others was needed to bind the grain. This modern photograph was made when one of the old machines was actually taken out into a field for demonstration.

After the patent was granted, he continued to work on improvements. In 1840 he sold his first two machines in Virginia. In 1843 his business branched out beyond the state. In 1847 he built a manufacturing plant of his own in Chicago, in the heart of the new grain-growing section of the Middle West.

McCormick soon proved that his talents as an inventor were equaled by his genius in business. He began manufacturing on a large scale, advertising, demonstrating, and guaranteeing his product, offering replaceable parts, and selling on the instalment plan. In spite of lawsuits and competition, he was for years the dominant figure in the industry. When the Civil War broke out, the 50,000 reapers in use released thousands of men for duty at the front. His machine won recognition abroad—in England in 1851, then in France—and ultimately throughout the world.

By 1875 the McCormick factories were yearly turning out thousands of reapers and mowers. Before the end of the century, they had introduced scores of other implements to speed up farm work and lessen its drudgery (*see* Agriculture; Reaping Machines).

MACDONALD, SIR JOHN ALEXANDER (1815–1891). For nearly half a century the history of Canada is the history of Sir John A. Macdonald—"John A.," as he was affectionately termed. Under his leadership four of the most significant events of that half-century were accomplished—the federation of the separate provinces into the Dominion, stretching from ocean to ocean and occupying half the area of North America; the acquisition of the vast Canadian Northwest from the Hudson's Bay Company; the building of the Intercolonial and Canadian Pacific railways to unite this far-flung domain; and the adoption of a protective tariff policy, which started the Dominion of Canada on its course of industrial prosperity.

Macdonald was premier of the Dominion from 1867 to 1873, and from 1878 to 1891. Other men originated policies; he put them into effect. Other men excelled him in powers of oratory, breadth of vision, and knowledge, but none had a more intense patriotism, and none equaled him in genius for leadership.

He came to Canada at the age of five, a poor Scottish immigrant boy. Poverty ended his schooling at the age of 15, but his insatiable curiosity and love of reading soon made up, in a large degree, for the lack of formal education. Entering a law office he was admitted to the bar at 21, and eight years later was elected to the Canadian Assembly. Almost at once he became one of the leaders of the Conservative party, winning a cabinet position within three years.

By 1864 the union of Upper Canada (Quebec), formed in 1841, was fast drifting into chaos because of party warfare and racial and religious jealousies. Macdonald's political tact made him the leader in the momentous negotiations which resulted in the establishment of the Dominion of Canada in 1867. He also was largely responsible for the adoption of the principle of centralization—the chief difference between the Canadian federation and the United States —whereby all powers not specially conferred on the provinces are reserved to the central government.

For his share in the great achievement of federation Macdonald received two signal honors—he became the first premier of the new Dominion, and he was knighted by Queen Victoria. In 1870 he was one of the British commissioners sent to Washington to settle the *Alabama* claims and the fisheries dispute. He was forced to resign office in 1873, but less than five years later he was again back at the helm, where he remained until his death.

MACDOWELL, EDWARD A. (1861–1908). In the history of music Edward MacDowell was the first American composer to win a place beside the great European masters. Although he received most of his training in Europe, it was in his native land that his poetic sensitiveness to beauty found its chief expression, and his most-loved compositions are those which show distinctly American influences.

Born in New York City of Scottish-Irish ancestry, he began to take music lessons when he was eight, but, like many another boy, was inclined to neglect his practising. Sometimes he stopped doing his exercises to improvise pieces of his own or to decorate his music books with pictures. There was some question as to whether he would become a painter or a musician.

When he was 15 his mother took him abroad to study. At the Paris Conservatory he was a fellow pupil of the French composer Debussy. Later, in Germany, he studied under the great composer Joseph Joachim Raff. MacDowell's genius had begun to show itself, for Raff said to him, "Your music will be played when mine is forgotten." At 20 the young American musician became an instructor in the Conservatory at Darmstadt. As a private instructor in Frankfort he had as one of his pupils an American girl named Marian Nevins, who became his wife.

When, after a dozen years in Europe, MacDowell returned to America, he had already won some fame as a pianist and composer. His work showed the influence of German romantic music, but he now became more individual, more American in his expression. The beauty of Nature, whether in the form of a simple flower or in its larger aspects—the woods, the vast ocean, the quiet splendor of the sunset—inspired in him moods which he translated into music distinguished for its creative imagination, its flawless structure, and its tone color.

In 1896 MacDowell was appointed to the newly established professorship of music at Columbia University, where he remained until 1904. The last years of his life were marked by failing health of body and mind. He had acquired a tract of wooded farm land near Peterborough, N. H. There for many years he spent his summers and found peace and rest from the nervous strain of teaching, and there many of his finest compositions were written. In fulfillment of a wish expressed during his last illness, and as a memorial, Mrs. MacDowell, with the aid of friends and music lovers, converted this estate into the MacDowell Colony. Here not only composers, but writers, painters, and sculptors spend their summers and find inspiration and opportunity for creative work.

Among MacDowell's works are 'Woodland Sketches'; 'Indian Suite'; 'Sea Pieces'; 'Sonata Eroica'; 'Sonata Tragica'; 'Norse Sonata'; 'Keltic Sonata'; symphonic poems—'Hamlet', 'Lancelot and Elaine'; many songs. Lawrence Gilman's 'Edward MacDowell' is a good study of his life and work.

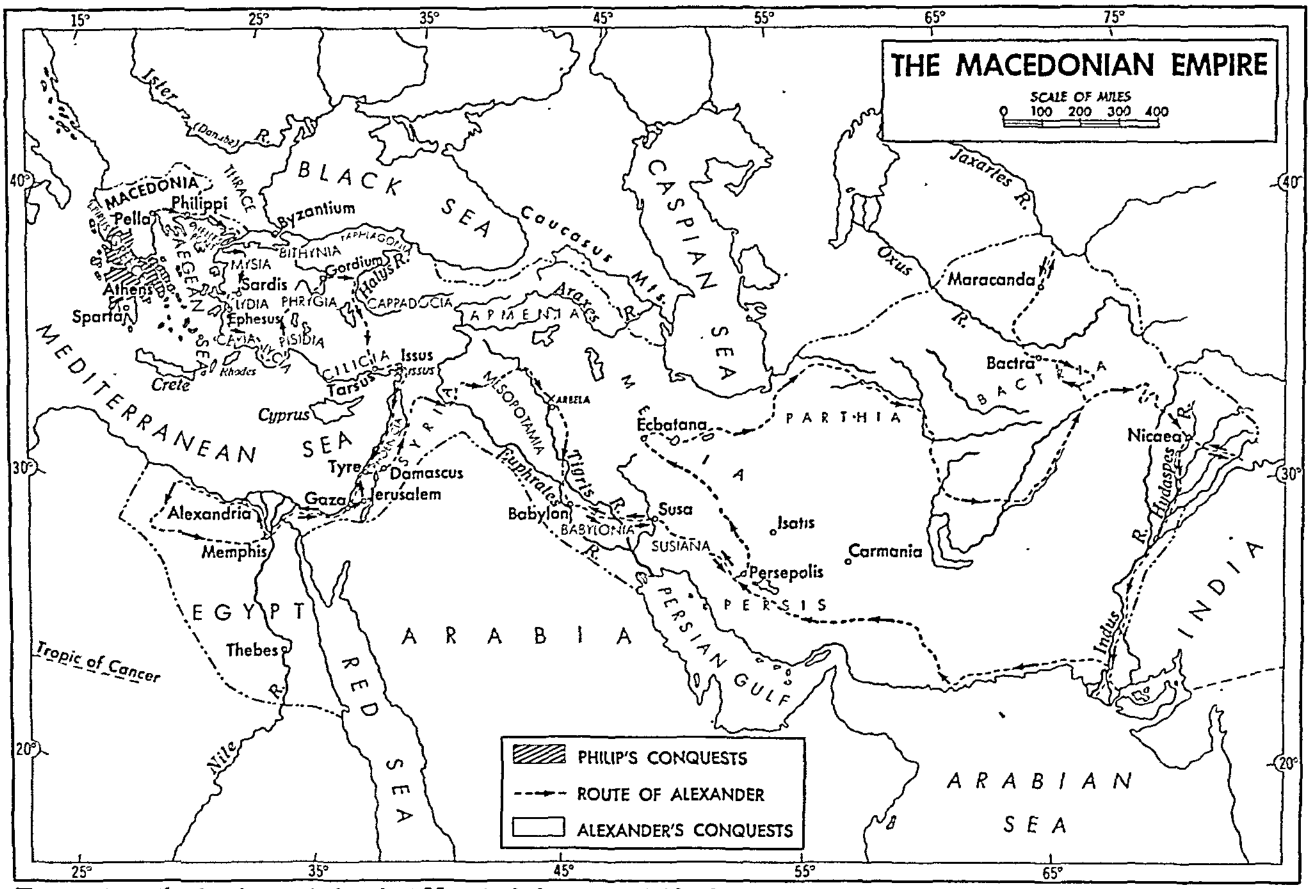
MACEDONIA. If you look for the boundaries of Macedonia on a modern map, you will not find them, because it is not a political unit. It is merely a sprawling, historical region which forms the top of the Greek peninsula and curves along the upper eastern and northern shore of the Aegean Sea. In general, the land rises from a wide coastal plain to rugged uplands. In some places, mountains extend to the sea. The chief city is Saloniki (*see* Saloniki).

Macedonia was once an independent kingdom, head of a vast empire, but for more than 2,000 years it has been divided among other nations. Today it forms parts of Greece, Yugoslavia, and Bulgaria.

The Great Macedonian Empire

Ancient Macedonia, or Macedon, was settled by a people whom the cultured Greeks to the south scorned as rude and barbarous. But in the reign of Philip II

THE GREAT MACEDONIAN EMPIRE



Here we trace the development of ancient Macedonia from a small kingdom to a vast empire. Philip II added most of Greece to his dominions. His son, Alexander the Great, became master of most of the then known world. A line marks the route of Alexander's victorious army from Pella, the capital of Macedon, to Asia Minor, around the Mediterranean to Egypt, and across Asia into India.

(382–336 B.C.), Macedon became a powerful kingdom. Philip built a great army and extended the borders of the kingdom to the north. Then in 338 B.C. he conquered Greece (*see* Greece). Thus he laid the foundation of what was to become a mighty empire. His son, Alexander the Great, conquered Persia and Egypt, and extended the Macedonian Empire across Asia to northern India (*see* Alexander the Great).

When Alexander was succeeded by weaker rulers, the empire broke into smaller kingdoms, which engaged each other in exhausting wars. In A.D. 197 Macedonia was conquered by the Romans and shortly afterward it was made a province of the Roman Empire. Beginning in the 4th century, it was overrun by Goths, Huns, Vandals, Slavs, and Bulgars. The Turks, in turn, seized it in 1371.

A Center of Confusion and Strife

Macedonia, with its great mixture of peoples, became one of Europe's storm centers. The five centuries of Turkish rule were marked by revolution and massacres. As the new Balkan states gradually won independence from Turkey, they sought control of Macedonia and its outlets to the sea. These rivalries flamed into the Balkan Wars of 1912–13 (*see* Balkan Peninsula), which were a prelude to the first World War. After the war, the larger part of Macedonia was divided between Greece and Yugoslavia, and a small strip became a part of Bulgaria. Again armed clashes occurred when Bulgarian Macedonians organized guerrilla bands of comitadjis ("committeemen") to fight for independence.

In 1923–24, when Greece and Turkey, aided by the League of Nations, exchanged minority populations, a large number of Greeks from Asia Minor settled in Macedonia. A few fairly peaceful years followed. Much of the malaria-ridden lowland was reclaimed, and small industries, such as rug weaving and silk weaving, were established.

With the outbreak of the second World War, the peoples of Macedonia again became involved in strife. Bulgaria, hoping to regain territory lost after the first World War, joined the Axis nations but again lost territory instead of gaining it.

Macedonian History

The original Macedonian people disappeared long ago. Their place has been taken by Serbs, Bulgarians, Vlachs, Albanians, Turks, gipsies, and Jews. Despite their differences in national heritage, language, and religion, attempts have been made to unite them into an independent Macedonian nation.

In 1945 the Communist government of Yugoslavia led a movement called the National Liberation Front of Macedonia. It aimed to bring Greek Macedonia into a "federation" dominated by Yugoslavia. Greece soon accused Yugoslavia of aiding Communist guerrilla bands in Macedonia. The surrender of the Greek

Communists in 1949 left that part of Macedonia in the hands of Greece. Economic aid from the United States helped to rehabilitate Macedonia.

ANCIENT AND MODERN TIMES MEET IN SALONIKI

A streetcar passes through a mutilated Roman arch. The arch was erected to commemorate the triumph of one of the Roman emperors, but archeologists disagree as to which emperor was so honored. Notice the sculptured figures on each of the abutments.

McGUFFEY, WILLIAM HOLMES (1800–1873). One of the most popular "best sellers" in America was a series of schoolbooks. They were titled 'McGuffey's Eclectic Readers'. The 'Readers' were first published in 1836. They were revised regularly until 1901, and over 120 million copies were sold. As educational needs changed, the books gradually lost popularity. But today they are valued by museums and libraries as historic items, and as keepsakes by people who read them in childhood.

William Holmes McGuffey, a college professor, compiled the books at the request of Truman & Smith, a Cincinnati publishing firm. With the help of his younger brother, Alexander, McGuffey prepared the 'First' and 'Second' readers in 1836, and the 'Third' and 'Fourth' readers in 1837. A 'Speller' and 'Primer' were soon added. Alexander McGuffey compiled the 'Fifth' and 'Sixth' readers several years later.

WILLIAM H. McGUFFEY

His 'Readers' brought good literature to America's pioneers.

Pioneer families especially welcomed the readers. Many of them had little schooling and few books or none at all. The McGuffey series was interesting and easy to read. The beginning books contained simple tales of American life. The more advanced readers contained extracts from the English classics. Pictures of children, animals, and familiar family scenes illustrated the stories.

Most of the stories had a moral. Readers were advised to be kind, obedient, thrifty, industrious, and patriotic. At one time 37 states used McGuffey's 'Readers' as standard textbooks. They were very influential in developing the literary tastes of 19th-century America. McGuffey received $500 for the original copyright to the 'Readers' and a percentage of the royalties. The publishers paid him an annual sum until his death.

William McGuffey was born in a log cabin in Washington County, Pa., on Sept. 23, 1800. His father, Alexander, had been an Indian fighter and scout. When William was two, the family moved to the Western Reserve in eastern Ohio. Again their home was a log cabin. As a boy William worked hard. He helped his father clear the land and start a small farm. His mother taught him to read and write. Later he hiked almost daily to near-by Youngstown to study Latin with the Presbyterian minister.

Young McGuffey had an exceptional memory. He often memorized whole books of the Bible. Besides Latin he also studied Hebrew and Greek. In 1818 he entered the Old Stone Academy at Darlington, Pa., where Reverend Thomas Hughes was headmaster. Having no money, William paid his way by doing odd jobs around the parsonage. The next year McGuffey enrolled in Washington College (now Washington and Jefferson University). Between terms he taught in rural schools to earn enough money to continue his studies. He graduated in 1826 with highest honors.

McGuffey's first professorship was at Miami University at Oxford, Ohio. He taught languages until

1832 when he became professor of philology and "mental science." At the same time he studied theology and was ordained a Presbyterian minister. While at Oxford, Ohio, he preached regularly at near-by Darrtown. He was a forceful lecturer and always spoke without notes or prepared text. McGuffey married Harriet Spinning in 1827. After her death, he married Laura Howard in 1857.

In 1836 McGuffey became president of Cincinnati College. While there he helped organize one of the first teachers' associations in the country. He was also active in support of a bill that authorized the first Ohio public-school system. Among his friends were Henry Ward Beecher and his sister, Harriet Beecher Stowe. McGuffey left

A PAGE FROM McGUFFEY

Pioneer families learned to read from McGuffey's books.

Cincinnati in 1839 to become president of Ohio University at Athens, Ohio. But lack of money forced the school to close four years later. During these years he did most of his work on the readers.

McGuffey returned to Cincinnati to teach at Woodward College. In 1845 the University of Virginia engaged him to teach moral philosophy. At Virginia he again spoke for the public-school system. He lived to see one established in that state. After the Civil War, McGuffey began work on a book of philosophy. He died on May 4, 1873, before finishing it. The house in which McGuffey was born was moved to Dearborn, Mich., by Henry Ford and reconstructed as part of Greenfield Village.

GUNS *That Fire* NINE SHOTS *a* SECOND

MACHINE GUN. Ever since firearms were invented, men have sought guns that would shoot faster than the single-shot weapon which had to be reloaded every time it was fired. Partial success was achieved in 1861 with the Gatling gun, invented by Dr. R. J. Gatling of Indianapolis, and with the French *mitrailleuse*, invented soon after. Both had a number of barrels that fired in turn as they were revolved around a central axis by a hand-turned crank. Sir Hiram Maxim, an American-born inventor working in England, was the first to invent a completely *automatic* weapon that loaded and fired itself after the first shot, as long as ammunition was supplied.

This invention came in 1881. In an improved form called the Vickers-Maxim, it was largely used by the British in the first World War. The Lewis gun, invented by Col. Isaac N. Lewis of the United States Army, was extensively used in this same conflict. In 1918 the United States Army adopted both the machine rifle and the machine gun invented by John M. Browning. The Browning machine rifle (now called automatic rifle) can be fired from the shoulder. It weighs 17 pounds with its 20-cartridge magazine. The Browning .30-caliber water-cooled machine gun weighs 48 pounds with a belt of 250 cartridges. The second World War model fired about 550 shots a minute. The .50-caliber gun fired 850 shots a minute. This powerful weapon weighs 121½ pounds and is fed by a 100-cartridge belt.

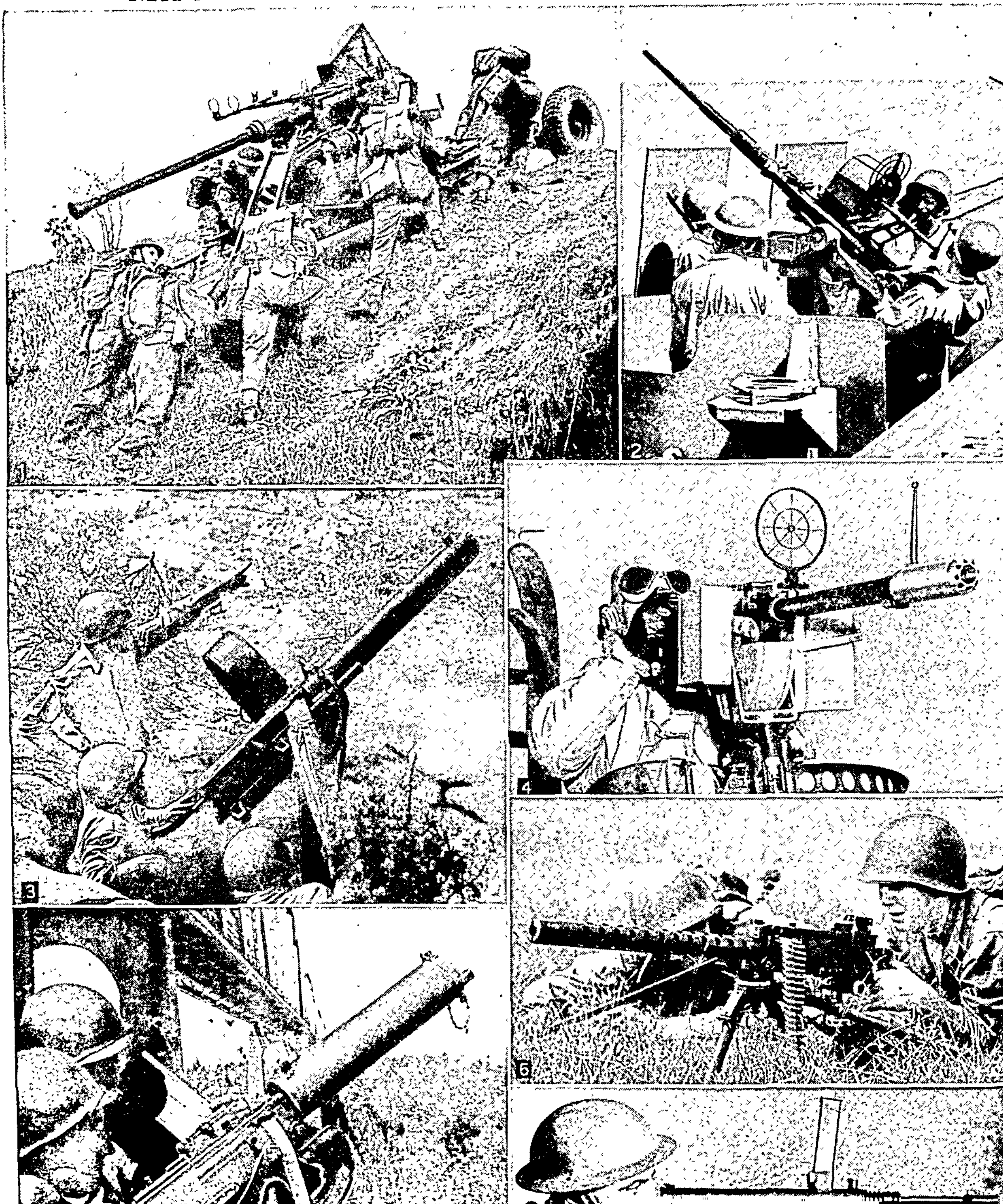
The term "machine gun" is now reserved for a weapon provided with a fixed mount. Automatic weapons that can be fired from the shoulder or hip without a rest are called automatic rifles or submachine guns. These may be fully automatic or only semiautomatic. The latter type reloads itself, but the trigger must be pulled for each shot. An example of this type is the Garand rifle of the United States Army (*see* Firearms).

A HEAVY BROWNING MACHINE GUN

This heavy machine gun is one of the most effective weapons devised for use against infantry attacks. Its two-man crew can hold up the advance of a whole battalion, especially if the gun is well concealed.

Automatic weapons may be activated either by the force of recoil or by gas pressure conducted backward from the barrel.

In addition to their use in ground warfare, machine guns were also used in airplanes. Some types are synchronized with the propeller so the bullets pass between the blades. With these, the pilot must keep the plane pointing at the target. Other combat planes and bombing aircraft have machine guns on revolving mounts. Most United States planes are armed with .50-caliber machine guns. Their cartridges can pierce light armor. Other planes carry an automatic 20-mm. cannon, equal to a caliber of about .78.



Here are leading examples of machine guns and automatic cannon used in the second World War. 1. A British crew and its Bofors cannon. This gun can fire more than a hundred 40-mm. shells a minute. 2. A navy Oerlikon gun ready to blast enemy aircraft with several hundred 20-mm. shells a minute. 3. An American .50-caliber, water-cooled Browning machine gun. 4. A .50-caliber, air-cooled Browning, mounted on an airplane, with a flash reducer on the muzzle, and a large airplane sight. 5. A .30-caliber, water-cooled Browning. 6. A .30-caliber, air-cooled Browning. 7. An Australian invention, the Owen submachine gun.

How a Typical Machine Gun Works

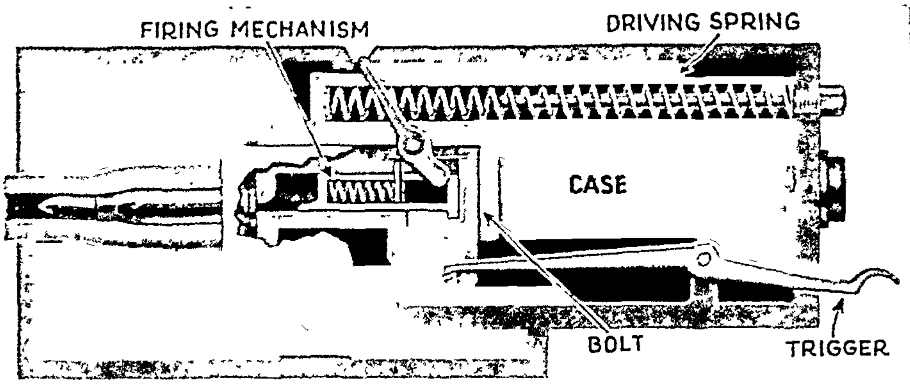
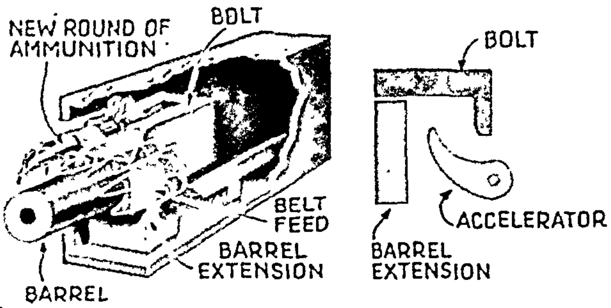


Fig. 1. The Principal Working Parts of the Browning Machine Gun

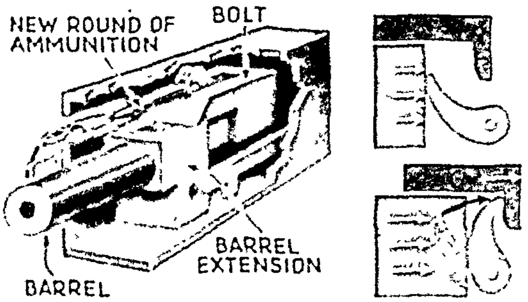
THE HEAVY Browning .30-caliber machine gun (picture 5 on the opposite page) is operated by the recoil force from each explosion. It has a tripod mount and receives ammunition from a belt. The large cylinder on the front of the gun is the water jacket. Water cools the barrel which becomes heated from rapid firing. The water, turned to steam by the heat, passes through a hose to a canlike container. If the steam escaped into the air, it might betray the gun position to the enemy.

The main parts of the gun, somewhat simplified to make them more readily understood, are shown in Fig. 1. Its construction can best be understood, however, by tracing the various operations step by step.

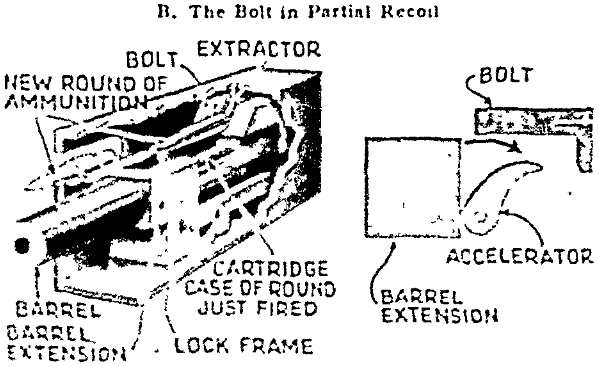
Fig. 2. How the Bolt Action Operates



A. The Bolt in Firing Position



B. The Bolt in Partial Recoil



C. The Bolt in Full Recoil

How Recoil Is Used to Work the Gun.—The operation of the gun is centered around the mechanisms shown in Fig. 2. The first piece of mechanism to notice is the barrel with its attached piece, the barrel extension. A second important piece is the bolt. A third is the driving spring, which is attached, as shown in Fig. 1, to the top of the bolt. Together, these three mechanisms absorb the recoil or "kick" from each shot and use its force to work the gun.

At the instant a shot is fired, these mechanisms are all together and well forward, in their firing positions (Fig. 2, A). The bolt, which contains the firing mechanism, holds the cartridge firmly while it fires. Then the recoil from the explosion starts driving these mechanisms back, and the bolt starts compressing the driving spring. At the same time, an extractor starts drawing a new cartridge from the belt.

All these parts together have considerable weight and so this first motion is relatively slow and does not jar the gun. Greater speed is needed, however, for the rest of the operations, shown in Fig. 2, B and C.

The barrel and the barrel extension cease their backward motion when they hit the stop, which is part of the lock frame shown in Fig. 2, C. Just before this happens, a cam on the stop has struck a lock (not shown in the diagram), which, up to now, has held the bolt fastened to the barrel extension. This releases the bolt from the barrel extension. Thereafter the bolt is driven backward still farther. The driving is done by the curved accelerator, which at the instant of firing, lies as shown at the right of Fig. 2, A. These diagrams at the right in each part of Fig. 2 show the interaction between barrel extension, accelerator, and bolt.

When the barrel extension recoils after a round is fired, it hits the accelerator and tips it backward. The tip of the accelerator starts moving toward the projection from the bottom of the bolt, but it does not strike until after the bolt has been unlocked from the barrel extension (Fig. 2, C). Then the barrel extension gives the accelerator a final push, and the accelerator throws the bolt backward.

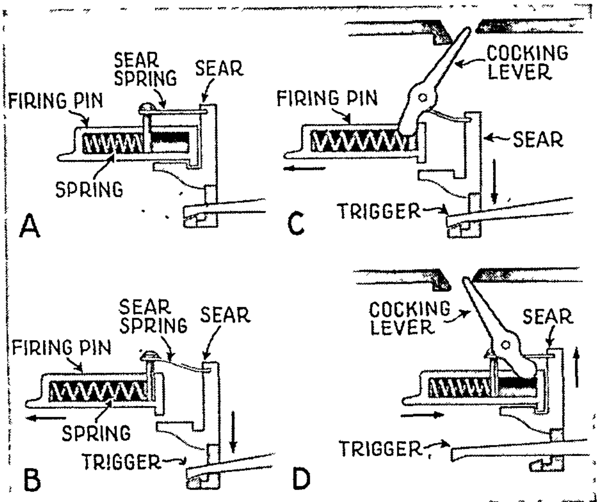


Fig. 3. The Firing Mechanism

The bolt continues to fly backward until it encounters a stop on the rear of the case. Then the driving spring, which has been strongly compressed, starts to drive the bolt forward again. Thereupon all the previous actions are reversed, until all the pieces come together again in firing position.

Reloading.—During this sequence of motions the gun has also been reloaded. This action started with extraction of a new round from the belt, as shown in Fig. 2, A. When the bolt is forced back from the barrel extension, it also pulls back the cartridge case of the expended round. At the proper moment a mechanism (not shown here) knocks the case out of the way.

When the bolt is fully back, a cam drives the new round down into line with the firing chamber. As the bolt moves forward, it pushes the round into position to be fired.

How the Gun Is Fired.—Before the gunner pulls the trigger for the first shot, the firing mechanism inside the bolt is in the position shown in Fig. 3,A. The firing spring is inside the firing pin, pressing against the sear spring pin at the back. A portion of the sear holds the rear end of the firing pin. The sear is held up in this position by the sear spring (3A).

Now the gunner pulls up the rear end of the trigger to fire the first shot. This *depresses* the front end of the trigger, and pulls down the sear and the sear spring (3B). This frees the firing pin which drives forward and fires the round (3B).

As the bolt recoils after the shot is fired, it carries the firing mechanism back with it. Thereupon the cocking lever (Fig. 3,C) prepares the mechanism for the next shot. This lever is pivoted to the bolt and moves with it. Moreover, as long as the bolt is forward, the upper end of the cocking lever is held in a slot in the case. Hence this end stays in place when the bolt starts back, and it compels the lever to pivot as shown and move the lower end backward against a flange on the firing pin. This drives the pin backward and compresses the firing spring. When the rear end of the pin comes over the notch in the sear, the sear spring pulls the sear up, and thus locks the pin. But now the bolt starts forward again, and when the projection from the bottom of the sear comes into contact with the trigger once more it is thrust downward, thus releasing the firing pin again (as in Fig. 3, C), firing another round. And so the action continues, as long as the gunner holds his pressure on the trigger.

How Ammunition Is Supplied.—The movement of the ammunition belt by means of the belt-feed lever is shown in Fig. 4. This lever is pivoted to the cover of the case, and stays in place while the bolt moves back and forth beneath it. It can move from side to side, however, on its pivot—and this motion is used to push the ammunition belt along across the top of the gun, as shown in Fig. 4 (A, B).

The side-to-side motion is timed by a stud which rests in an S-shaped groove on the upper surface of *the bolt (4A). When the bolt recoils, the curving* groove forces the stud to the right, and the front of the lever carries a slide to the left (4B), over the cartridge belt. Inside the slide a belt-feed pawl and spring are held, as shown in 4C, until they come to the left of the new round. Then the spring forces the pawl down, as shown in 4D.

As the bolt moves forward from the full recoil position, it reverses the movement of the belt-feed lever, and pushes the slide back toward the right. But the pawl now pushes the new round to the right as well, into a position where the extractor can grip it. The extractor does so the moment the bolt comes into firing position—and then everything is once more ready to fire a round, and start the entire sequence of motions over again.

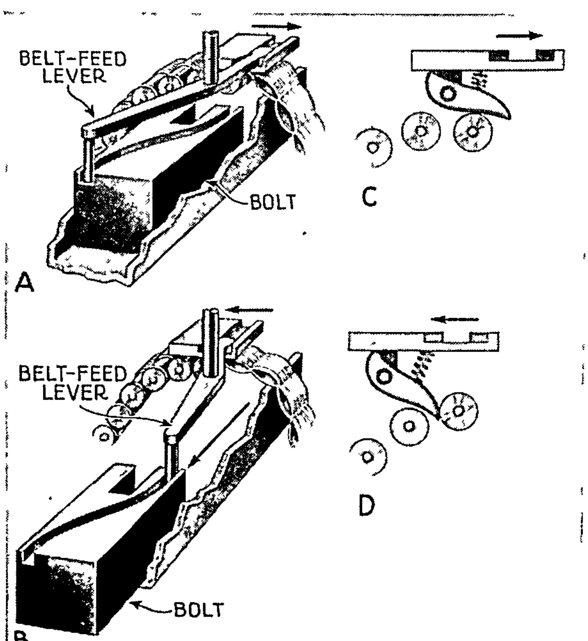


Fig. 4. Moving the Belt to Feed Ammunition

MACHINERY. Machines are man's answer to the ever-present problem of securing greater results in the time allotted for a task. They are something more than tools, by which man supplements the power of his hands. In the physical sense, most tools are simple machines, for they enable a man to produce more work with less energy (*see* Physics). But, practically speaking, a machine performs repeatedly a complicated and more or less complete task at an actual saving of time and labor.

We are often told that this is a machine age, and that machines are dominating life to an ever-increasing extent. It is true that they have become so important in our lives that there is scarcely anything we make or use that is not touched by the machine. Instead of a simple, self-contained primitive existence, in which each family produces for itself most of those things which it needs, machines have made life an "assembled" affair, to which many machines must contribute. We wake to the ringing of a machine, eat a breakfast cooked over gas or electricity propelled into our homes by a machine, read newspapers printed by machines on paper made by other machines, and ride to business in machines.

Our dependence on them is such that the breakdown of a single generator in a power house may deprive a whole community of light, heat, refrigeration, water supply, transportation, the power to perform ordinary household tasks, and possibly the means of livelihood itself.

How Machines Have Brought Leisure

But this dependence upon machines for simple acts of daily life is but one aspect of the Machine Age. Machines have made us far better off than before in two big ways. First, they have enabled us to do our work in less time than by hand; thus we have more time to ourselves (leisure time). Second, they have enabled us to make more and better things in the same amount of time; thus we have more things to enjoy in our leisure. Think of the bicycles, automobiles, boats, books, and scores of other machine-made things we have to use outside of our working hours.

The United States shows better than any other nation how machines multiply our working power. With only one-sixteenth of the world's population, the United States in some years has performed one-half of the work done in the world. An average worker in the United States may produce 30 times as much as an average worker in China, where hand methods are used.

Utilizing Natural Resources

Modern business is an expression of the wealth-creating power of machinery, and it is equally at the mercy of machine development. There are industries, once thought essential, which have sunk to relative insignificance by the introduction of machines and new methods of production. Science, working hand in hand with business, has devised methods of utilizing the natural resources of the world through machinery, with the result that mere man power and animal power have been almost supplanted by energy produced from water, coal, and oil (*see* Power). With the almost unlimited energy thus available, business has been able to embark on programs of mass production impossible with hand methods. For example, one American plant making automobile frames with automatic machinery has employed 200 men to produce 7,000 frames daily. Contrast with this a European plant using hand methods; it also has employed 200 men but has produced only 35 frames a day.

Do Machines Supplant Human Labor?

It has been charged that machines thus supplant the labor of men, and that a growing use of machinery results in a steady decrease in employment. However, in 1890, when industry was only partly mechanized, 36.1 per cent of the population of the United States was gainfully employed. In 1940, 40.1 per cent of the total population was included in the labor force. This would indicate that the use of machinery does not decrease employment. More men are required to manufacture the machines themselves, to supply them with raw materials, and to transport and market the ever-increasing stream of finished products poured forth from more and more machines. Machines tend to lower costs, with a consequent reduction of prices, which in itself widens the market by making the goods available to a larger number of people, increasing demand and bringing still more goods within the range of people's pocketbooks. (*See* Economics.)

It can be charged to machinery, however, that it shifts employment; and its introduction may tend to upset conditions of employment for a time, until workers have been placed elsewhere in the complex organization involved in production, distribution, and sale. This is known as technological unemployment. (*See* Industrial Revolution.)

Mass Production and Overproduction

Mass production by machinery has been blamed for periods of economic depression; but economists are by no means agreed that overproduction is to blame. It may be that men, in their increasing use of machinery, have failed to take advantage of the leisure to which the machine entitles them, and by working too long hours are encroaching upon the status of other workers. Whatever may be the truth, overproduction is a misuse of the machine's function, which is the satisfaction of man's needs, and is not a fault of the machine itself. Some regulation of production will not affect the utility of machines if it has a basis in social and economic justice. They will continue to be of service to men.

It was this service to mankind that led to the development of the first machines. Simple ones, such as the lever, the wheel, the inclined plane, the screw, and the wedge, have been known for ages. At first these constituted the only machines, and by them men could do more work than with their unaided hands. In essence, they were basic mechanical methods which are applied to even the most complicated mechanisms.

The very name first applied to machines—*engines*—signified something that produced within itself.

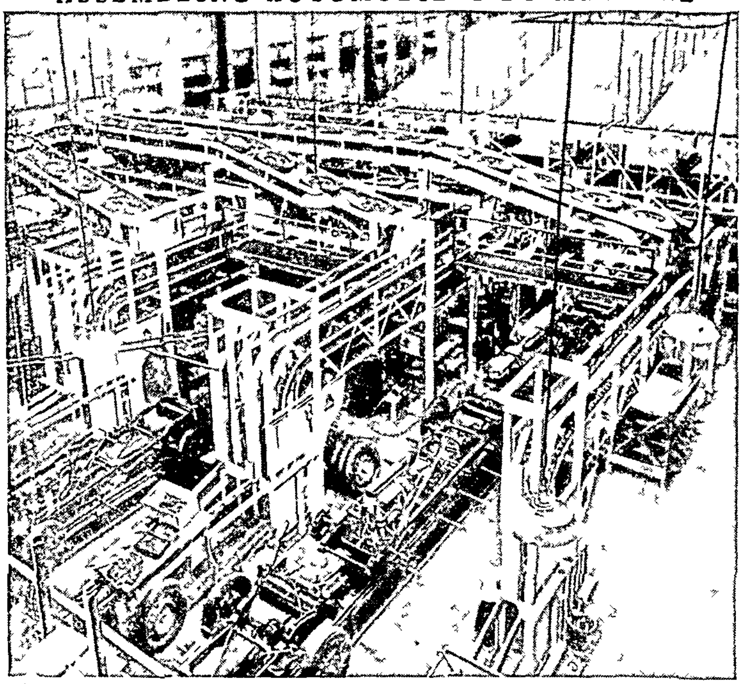
There were engines of war, such as ballistae and catapults which could cast stones farther than men could hurl them, rams which could batter down walls otherwise impregnable, and peace-time applications of these and other basic mechanical principles. When steam was discovered as a source of power, the term engine came to be used only to signify machines capable of developing power by steam. With the advent of the internal combustion engine, the word has been extended to include all prime movers, or machines that transform heat energy into power. The electric motor, thus, is not considered an engine, as it takes energy already produced by a generator. The term engine is also applied to machines which produce fine divisions or calibrations on scales, precision tools, and scientific equipment; and we also have the term "engine turning," applying to the production of intricate designs on watch cases and on plates for printing currency and securities.

In the modern sense a machine differs from a tool, being more complex, and repeating its operations over and over again. It would be impossible to list even the classifications into which machines fall, or to describe their complexities, and yet every one is only a combination of simple machines in the mechanical sense in which we use the word. The automobile is composed of screws, levers, wheels, inclined planes, wedges, and so on. The cylinder head, for instance, is held tightly to the cylinder block by a series of bolts (screws). The connecting rods are levers, pushing against the crankshaft; the timing gears are special forms of the wheel; the inclined plane is found in the cooling fan, for its blades push a load of air; while brakes are sometimes operated by wedges.

The automobile is a splendid example of the modern machine, for it is the product of scores of specially designed machines and of processes that came into existence for the sole purpose of aiding in the production of motor cars. Itself a machine, it has been responsible for other machines, for special materials, and for auxiliary parts and processes that have contributed to progress in other respects since their first use in motor cars. (*See* Automobile.)

A high degree of precision has been developed in the automobile business, particularly in the finishing of parts, both to reduce wear and to make it possible to assemble and replace parts that will fit accurately without hand work. This is a characteristic of modern machines, which are made to an amazing degree of accuracy, and are capable of producing work within tolerances narrower than the ten-thousandth part of an inch.

ASSEMBLING AUTOMOBILES BY MACHINE



The automobile is itself a complex machine, and in its manufacture many other machines, as well as complicated tools, are used. On such great machines as these shown in the picture are the automobiles assembled. The various parts are brought together automatically, placed in position, and a minimum of hand labor with tools assembles them, a task that would be impossible without the accuracy of modern tools and the perfection of machines.

This uniformity of production, required by modern business, and made possible by the machine, compels the manufacturer to exercise rigid inspection over production. Skilled help to operate machines is still a necessity, which is one reason why manufacturers using mechanical methods are likely to locate in districts with similar manufacturers. Detroit is the center for automobile production; Akron for rubber goods; Troy, N. Y., for laundry machinery; and textile manufacturers tend to center in certain New England and Southern districts.

Machine Tenders Replace the Craftsman

But with this experience in machine tending has come a lessening of the supply of skilled craftsmen capable of performing all operations in the manufacture of a product. Except in a few cases, no longer does a shoemaker fashion an entire shoe, nor a gunsmith produce a rifle, lock, stock, and barrel. Rather, skilled machine tenders preside over countless operations, each doing infinitely well and with great speed, a single detail in manufacture. There is a constant tendency in industry to utilize the machine more and more, particularly in combining various operations and processes into one machine handling. We thus have cable-making machines that take bare wire and turn out finished cable, and machines that not only produce a product but wrap it and package it as well, and many others. (For further discussion of common tools and machinery that performs definite operations, *see* Mechanics, Tools.)

MACKENZIE, WILLIAM LYON (1795–1861). As inspirer and leader of the unsuccessful rebellion of 1837, William Lyon Mackenzie occupies a place in Canadian history much like that of Daniel Shays and John Brown in the history of the United States. Honest in purpose, enraged by intolerable evils, but hasty, imprudent, and fanatical, he took up the sword to cure the ills which afflicted Upper Canada (Ontario). The rebellion itself was quickly crushed but it hastened by years the redress of the grievances which provoked it.

Mackenzie had come to Canada from Scotland at the age of 25, after a youth of poverty and toil. He found in Upper Canada increasing discontent against the autocratic rule of a stubborn Tory governor and a small political clique, nicknamed the "Family Compact," which monopolized public office. First at Queenston, then at Toronto, Mackenzie published a newspaper, *The Colonial Advocate*, in which he demanded governmental reforms. Just as he was on the point of ceasing publication for lack of funds, a mob wrecked his printing office, and the heavy damages awarded him by the courts enabled him to start anew. His last paper was named *The Constitution*. Five times elected to the parliament of Upper Canada, he was five times expelled by his political foes. In 1834 he was elected first mayor of Toronto (formerly York) and was returned to parliament, this time being allowed to take his seat, since the Reformers were now in the majority. Two years later, trickery and bribery again swung the elections against the Reformers, and Mackenzie soon began openly to advocate a republican form of government, working with the Reformers of Lower Canada (Quebec) who were already planning revolt (*see* Papineau, Louis Joseph).

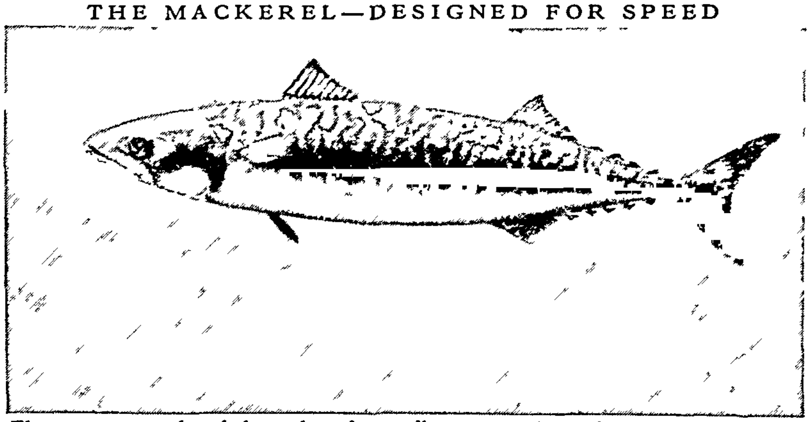
On Nov. 25, 1837, Mackenzie proclaimed a provisional government for Upper Canada and by Dec. 7 he had gathered a force of 800 or 900 insurgents near Toronto. The rebels were speedily routed by the government forces, and Mackenzie fled to the United States. Seizing Navy Island in the Niagara River, he troubled the Canadian frontier for a few weeks, but was captured by the authorities of the state of New York and imprisoned for breach of the neutrality laws. He was released a few months later and remained in the United States until 1849, when the passage of an amnesty act allowed him to return to Canada. From 1851 to 1858 he was a member of the Canadian parliament, allied with the Extreme Radicals.

MACKENZIE RIVER. The greatest river of Canada and the second greatest in North America, the Mackenzie, flows 2,635 miles from its source in the Rocky Mountains to the Arctic Ocean. It drains an area which is 100,000 square miles larger than the basin of the Great Lakes and the St. Lawrence. In its course it gathers the waters of three immense lakes—two of them larger than Lake Erie—Lake Athabaska (3,058 square miles), Great Slave Lake (11,170 square miles), and Great Bear Lake (12,000 square miles). Great Bear Lake lies so far north, partly within the Arctic Circle, that its surface is frozen for nine months of the year.

From its source to Lake Athabaska, this mighty river is known as the Athabaska River; thence to the Great Slave Lake, as the Slave River; and from there on to its mouth as the Mackenzie. In summer steamboats of the Hudson's Bay Company travel from Great Slave Lake almost to the river's mouth, where it spreads into many branches through a wide flat delta. The Athabaska and its other great tributaries, the Peace and the Liard, are navigable much of their length for steamboats of shallow draft. Nowhere is the Mackenzie proper less than half a mile wide, and in its widest reaches it expands to three and four miles. Most of its course is through virgin wilderness, heavily wooded in many of the upper parts, a paradise for sportsmen and trappers. Large deposits of oil have been discovered on the Mackenzie River only 150 miles south of the Arctic Circle.

The Mackenzie was named for Sir Alexander Mackenzie (1763–1820), a Scot employed by the North West Company. People believed that a northwest passage connected the Atlantic and Pacific oceans, and the British government offered a reward to the man who could find it. In 1789 Mackenzie set out with a party of French Canadian *voyageurs* and a few Indian guides, paying all expenses out of his own pocket. He explored the river to its mouth where it entered the Arctic Ocean. Three years later he led a small group of men across the north Canadian Rockies, overcoming precipices and glaciers by tremendous effort. He was the first white man to make the trip.

THE MACKEREL—DESIGNED FOR SPEED



The common mackerel shown here is usually no more than a foot long and a pound in weight. But its lines and fin pattern are typical of the whole mackerel family, which ranges upward in size to the giant tuna. The members of this family are the fastest swimmers in the sea.

MACKEREL. One of the important commercial and excellent food fishes of the world is the mackerel. It is a streamline, swift-swimming fish usually 12 to 16 inches long with a deeply forked tail. It has beautiful protective coloration—bluish-green above, mottled or barred with black, and silver beneath.

Mackerel are found in nearly all tropical and temperate seas and travel in vast schools, some miles long. They spawn in the open sea, but as the temperature warms they migrate toward shore in pursuit of myriads of tiny crustaceans, especially the red copepod. They also eat small fish and eggs. Larger fish, such as porpoises and sharks, prey upon them.

Off the New England and Middle Atlantic states, Nova Scotia, and southern California, and in Norway, Ireland, and Great Britain, mackerel fishing is important. The annual supply varies greatly. In the Atlantic, fishing extends from April to early fall. The catch is taken mainly by purse seines or nets used to surround schools. Most of the Atlantic catch is shipped fresh or frozen. Off California purse seines and scoop nets are used. Most of the fish taken in the fall are canned. (*See also* Fisheries.)

Scientific name of the common North Atlantic, or Boston, mackerel, *Scomber scombrus;* of the closely related Pacific mackerel, *Pneumatophorus diego*.

McKINLEY, MOUNT. In the south central portion of Alaska stands Mount McKinley, the highest mountain in North America. It rises from the Alaska Range 20,269 feet above sea level and 17,000 feet above timber line. Two peaks crown Mount McKinley; the south peak is 899 feet higher than the north. The snow line lies at about 7,000 feet. Above it, ice and snow shroud the mountain the year round.

The natives called it Bulshaia, Traleika, or Denali ("great"). The first white men to see Mount McKinley were Capt. James Cook and George Vancouver in about 1778. It was named in honor of President McKinley by W. A. Dickey in 1896. Mount McKinley National Park was created by act of Congress in 1917. It has an area of 1,939,319 acres. It is second in size only to Yellowstone among national parks.

Beginning in 1903, many attempts were made to scale the mountain. Finally in 1913 Archdeacon Hudson Stuck and three companions succeeded in reaching the top of the higher southern peak.

McKINLEY—WAR PRESIDENT *and* MARTYR

McKINLEY, WILLIAM (1843–1901) The gentle soul of William McKinley of Ohio, 25th president of the United States, left on the men who knew him an impression that time did not efface. On his birthday, January 29, it was their custom to wear the red carnation that was his favorite flower. His invalid wife, who outlived him, was their special charge until her death. They built him a mausoleum at Canton, Ohio, that has become a place of pilgrimage. And the tragic nature of his death, at the hands of an anarchist, emphasized for them the usefulness of his life, the kindliness of his manner, the tolerance of his policies.


WILLIAM McKINLEY

Less able than Harrison, less steadfast than Cleveland, less inquisitive than Theodore Roosevelt, McKinley understood the people of the United States and the men whom they elected to make their laws. During the four years of his high office, he drew the sections together, doing much to heal the wounds of the Civil War. Himself a member of Congress for 14 years, he knew how to lead that body to work with him. His appointments were often distinguished for their excellence. And his sympathies were so gracious that even his bitterest opponents found it hard to fight him. He helped to ease the nation through the difficult transition from small affairs to big business, from the flexibility of open opportunity to the rigidity of economic and social classes, from local interests to world affairs.

In another way McKinley marked a transition, for he was the last of the presidents whose political careers were founded on military service in the Civil War. Born at Niles, Ohio, he went to public school for a time, and then worked for his father in the iron foundry established by his Scottish-Irish grandfather. He attended Allegheny College for a year, but withdrew on account of bad health and for several terms tried teaching school. In the spring of 1861, although only 18, he promptly volunteered, and was mustered into service in the 23d Ohio Volunteers. At Antietam his gallantry was cited by Rutherford B. Hayes, then colonel commanding his regiment, and won him a commission.

At the end of the war the 22-year-old major (for he had been gradually promoted to that rank), studied law for two years, and began to practise in Canton, Ohio. In 1869, the young Republican was elected prosecuting attorney in a Democratic county. In 1871, he married Ida Saxton, daughter of a prominent local family. The shock of the early deaths of their two daughters left Mrs. McKinley a nervous invalid, to whom McKinley for the rest of his life devoted practically every minute of the time that other men allotted to recreation or society. Ever dignified and serious, and never learning really how to play, McKinley worked strenuously at both law and politics, and at 34 he appeared on the national

stage as a congressman, in the administration of his friend and war commander, President Hayes.

Early Political Career

During the seven terms of his career in Congress, McKinley rose steadily in the organization of the Republican party. He never questioned that the party was always right. His constituents in Ohio were manufacturers, and their interest in a protective tariff led him to vigorous support of protection as a party principle. He early studied the subject, believing that after the confusion of the Reconstruction years the tariff would come to be a major problem. As it grew in importance, he grew with it. He wrote the platform of the Republican party in 1884 and in 1888, and was made chairman of the committee on ways and means in the Congress that met in 1889. The McKinley Tariff, passed in 1890, was the first systematic revision of the tariff in the direction of protection to all American manufactures. McKinley, whose name it bore, was the best known of the tariff statesmen; and when the Democratic party made war on protection and repealed the bill in 1894, McKinley was the obvious man to restore it. The panic of 1893 struck the United States at the moment when the Democrats were reversing the tariff policy, giving Republican leaders an opportunity to blame them for causing it.

During the years of depression, McKinley, then governor of Ohio (1891–95) and "advance agent of prosperity," aimed at the Republican nomination for the presidency in 1896. He was supported in this ambition by Marcus A. Hanna, an Ohio business man and political leader, who loved McKinley for himself, favored him as spokesman for protection, and spent his private means to advance his friend. McKinley and Garret A. Hobart, of New Jersey, were nominated on the Republican ticket at St. Louis in June 1896. But the fight for election proved to be on an issue other than the tariff: "free silver" was the issue before the country, and to it all other problems were subordinated as the presidential campaign progressed.

Free Silver; 16 to 1

"Free silver" was the slogan of the Populists, a hard times party, that demanded more money in circulation, and cheaper money, so that the debtor farmer might receive higher prices for his produce and find it easier to pay his debts. Already the pressure from West and South had forced upon Congress in 1878 the Bland-Allison Act, and in 1890 the Sherman Silver Purchase Act. Free silver, as now demanded, meant that although enough silver to make two dollars could be bought for one dollar in gold, making the silver dollar actually worth but 50 cents, the United States should continue to make the silver

ENLISTING FOR THE 114-DAY WAR

McKinley would have avoided the conflict with Spain, but newspapers so aroused public opinion that war was inevitable. Here in a New England village volunteers sign up for service. Notice the bearded Civil War veteran who has brought his son to the station.

dollar at the same old weight, fixed when one ounce of gold was worth only 16 ounces of silver. This was "16 to 1." The "free" meant that the mint should coin freely at this ratio (16:1) all silver brought to it, and that there should be no check upon the amount of silver money except the total output of the silver mines. In other words it was unlimited coinage.

McKinley was elected president in 1896, after a bitter canvass in which the parties divided on lines of social and economic classes more than ever before.

William Jennings Bryan, the Democratic nominee, was the great orator for free silver, and had the support of people in sections that were poor because of the panic, or depressed because of debt. Behind McKinley were the sections and people who were well off, who feared a 50-cent dollar, and who thought that it would be dishonest for the United States to pay its debts in money of only half its usual value. The issue of protection, upon which McKinley had built his earlier reputation, had already brought within Republican ranks most of the wealthy manufacturers. Republicans said that Democrats and Populists wanted to repudiate their debts; Democrats answered that the Republicans had become a party of entrenched wealth and corrupt privilege for special interests.

The election returned a Congress Republican in both houses, so that during the next four years McKinley could fulfill party pledges as to both sound money and the protective tariff. More than this, the party that elected McKinley was so strengthened by victory, and the party of Bryan was so weakened by defeat and internal quarrels, that for 14 years after 1897 there was unbroken Republican control of president, Senate, and House of Representatives. Prosperity had begun to reappear even before election day; it continued on a vast new scale that threw into the shade the last boom period of the 80's.

McKINLEY'S ADMINISTRATION
1897–1901

Dingley tariff passed (1897)
Gold discovered in Alaska (1897).
Marconi makes "wireless" practicable (1897).
Battleship 'Maine' blown up in Havana harbor (Feb. 15, 1898).
War with Spain follows (1898).
Philippines, Puerto Rico, Guam, and Cuba acquired by Treaty of Paris (1898).
Hawaiian Islands annexed (1898).
Samoan Islands divided with Germany (1899).
Philippine insurrection suppressed (1899) and civil government prepared for.
United States participates in First Hague Peace Conference (1899).
Secretary Hay secures "open door" policy in China (1899).
Troops sent to China to aid against Boxer uprising (1900).
Gold standard adopted (1900).
McKinley reëlected on "full dinner-pail" platform (1900).
Assassination of McKinley (Sept. 6, 1901).

A New Era

The Industrial Revolution, beginning in the 18th century, passed through several phases as it changed the life and habits of society. First, it brought steam to replace wind, water, and the labor of animals as the power that served society. Manufactures and the factory system were its immediate products. Then it brought changes in communication, as steamboats and traveling engines made their appearance in the second quarter of the 19th century. Manufactories indeed continued to increase, but the most visible changes of the second period were in transportation. Then came new inventions, in the application of electricity, to carry the results of the Industrial Revolution into every walk of life. And every new invention made new jobs, and set up new industries, and crowded old cities with new workers to meet the new demands. As McKinley drove along Pennsylvania Avenue in the inaugural parade with Cleveland at his side, a moving-picture camera clicked a record of the spectacle, serving notice that the eye of man was now to extend its range as the ear had done in the previous phase of the Industrial Revolution, through the telegraph, the telephone, and the phonograph.

Man extended his range on land and sea. From the triumph of Alexander the Great until the defeat of Napoleon, the speed of man, on land, was the speed of his horses. The railroad, in the second phase of the Industrial Revolution, quickened his pace for the first time in centuries. But now, over land, under the sea, and even through the air, new inventions were ready to increase man's command over his environment. The inventors, Holland and Rose, had a submarine boat that was beyond the experimental stage and that was in a few years to make the romance of Jules Verne tamer than reality. Langley, of the Smithsonian Institution, had a flying machine that came near to anticipating the feat of the Ohio bicycle mechanics, the brothers Wright, who glided into the air before the second term of McKinley had run its course. The horseless carriage had arrived. In 1900 the first automobile show was held in New York; only 31 years later a single manufacturer, Henry Ford, had turned out the unbelievable total of 20,000,000 automobiles.

A new life was to be lived in a new world. Between 1890 and 1930, the United States doubled in population, from 62,947,714 to 122,775,046. Its people were drifting into the cities, their lives losing the variety and exercise that existed on the farm. Recreation and sport were no longer incidental; they must be pursued. Tennis and baseball for the young, golf for the middle-aged, and professional baseball, football, and other diversions for those who took their exercise sitting down, were the necessary accessories of city life. The abundant means that brought these within the reach of ordinary people brought other things—better homes, a greater variety of clothes, more healthful foods, and more education for more of the children. McKinley lived to see only the beginning of the new period, but he never lost his belief that the government of the United States would enable the people to meet the varied problems of the new life—problems certain to arise in prosperity.

The Age of Big Business

Hand in hand with the prosperity of the new age went the organization of the business that managed it. Before 1890, when the Sherman Anti-Trust Act was passed, the people had become nervous about the railroads and the trusts. They had better reason now for more nervousness. Working through the banks

that loaned money and financed new companies, many of the ablest men of the United States were becoming money kings. John D. Rockefeller, whose fortune came from petroleum, was the personification of monopoly in the manufacturing business. J. Pierpont Morgan, head of a banking house in New York, had rescued the Treasury in the hard times of Cleveland, and now took the lead among *promoters and money-lenders.* James J. Hill and E. H. Harriman were identified with building great railroad systems and consolidating little lines by gigantic mergers. The Sherman law seemed to have no influence on the tendency of business to consolidate, and the men of vast affairs did not want it to restrict their ventures. The successors of McKinley were destined to face the agencies of big business, and were forced to work out a policy respecting them.

JOHN HAY

McKinley's secretary of state ranks as one of the greatest of American diplomats. He was the author of the "open door" policy in China.

The men whom McKinley brought into his Cabinet to direct affairs were practical men who believed that if people were prosperous they would be happy, and that if government protected its own credit and the business of its citizens, the citizens would be prosperous. John Sherman, who had been secretary of the treasury under Hayes, was appointed secretary of state, leaving vacant his seat in the Senate for Mark Hanna, McKinley's friend.

Congress met in early special session to repeal the low Democratic tariff, and to restore high protection in the Dingley Bill (1897). Three years later, in 1900, it took up the stability of the currency, passing the Gold Standard Act, in which it declared that the standard dollar of the United States should be the gold dollar, and that all other forms of money in use should be redeemable in gold on demand. The wave of prosperity now ran so high that the demand for free silver had largely disappeared; because farmers, when they had money, did not want it to be cheap. The low prices of the panic years had begun to yield to higher prices, for even the gold dollar was declining because of a flood of new gold from the Alaska mines. These discoveries, repeating many of the experiences of the California gold boom, caused excitement and a rush to the gold fields, and produced bullion enough to lower the value of gold throughout the world.

Rubbing Against the World

McKinley had new problems of another sort because the Spanish-American War left the United States carrying new responsibilities, and dealing in new intimacy with the great powers of Europe and Asia. Some of these powers were deliberately devoting themselves to a new policy of "imperialism," which meant that each was trying to acquire for itself as much as possible of the backward areas of the world. The United States could not have escaped contacts with it, even had there been no war in 1898; but the war brought it sharply before the American people. (*See* Spanish-American War.)

McKinley did not wish the war with Spain, but did not see how he could prevent it. When it left the United States in temporary possession of the Spanish colonies, he did not see how the United States could either return them forcibly to Spain, or turn them loose to be seized by eager imperialistic nations. Meanwhile Secretary Sherman, now 75 years old, decided to retire. His assistant, William R. Day, was appointed secretary of state, but held the place only six months when he became chairman of the United States commission to negotiate peace with Spain. Then President McKinley appointed John Hay, whom he had sent to London a year earlier as ambassador. A better choice could not have been made. Originally a public figure as secretary to President Lincoln, Hay had seen diplomatic service at Paris, Vienna, and Madrid, had been assistant secretary of state for two years in Hayes' administration, had been editor of a great New York newspaper for seven years, and then had retired to work on his monumental book, 'Abraham Lincoln: A History.' During the next seven years he was to prove himself one of the greatest American diplomats.

As soon as the transfer of the Philippines was ratified by the Senate, Secretary Hay took up with the new neighbors, who held possessions in or near China, the question of the status of the Orient. Germany, England, France, and Russia were hopeful of making gains in trade and possessions as China went to pieces. They assented, only with reluctance, to Hay's proposal of an "open door" policy, which provided that they forego exclusive advantages in China for themselves. In 1900, when revolution in China broke out, and many foreigners were besieged in the foreign quarter of Peking (or Peiping), McKinley sent United States troops with the relief column, and Hay brought pressure upon the other powers not to use the revolution as an excuse for further dismemberment of China. After McKinley died, Hay continued in office, until his own death in 1905.

In Cuba, the pledge of the United States was carried out after the Spanish armies had been taken home. Gen. Leonard Wood, whose great abilities had been revealed during the war with Spain, was appointed military governor of the island, and in 1900 he summoned the people to a constitutional convention to erect a republic. During 1902 the flag of the United States was withdrawn, and Cuba was left to direct her independent affairs, subject only to the "Platt Amendment." This was a declaration adopted by Congress in 1901; it provided that the United States might establish naval bases in Cuba and might intervene to maintain order, and that Cuba would not create debts which it could not pay out of ordinary revenues, or surrender its independence to any power.

The new interests in the Pacific Ocean, centering in the Philippines, were strengthened by the annexation of the Hawaiian Republic. Formed by revolution in 1893, this republic had immediately sought annexation to the United States. Cleveland had prevented this, believing that the revolution had received improper aid from Americans; but the new McKinley administration quickly brought about annexation by joint resolution of Congress, July 7, 1898.

The war revealed how useful to the United States would be a canal across the Isthmus of Panama. Under the Clayton-Bulwer Treaty, however, Great Britain had equal rights with the United States over any isthmian canal. After lengthy negotiations, which almost failed at one stage because the British government declined to ratify the first draft of the new treaty, Secretary Hay and Lord Pauncefote, British ambassador to the United States, produced the Hay-Pauncefote Treaty, which was ratified in December 1901. It specifically abrogated the Clayton-Bulwer Treaty, gave the United States the right to exclusive ownership, permitted fortification of the canal and its approaches, and omitted the former requirement that the canal should be kept open to all nations in time of war as in peace. The treaty also provided that no change in the sovereignty of the territory crossed by the canal should alter the principle of neutrality and of equal rights to enjoy the benefits of the canal.

The Tragedy of 1901

Through his first four years, President McKinley continued to grow in popularity. The prosperity of the United States weakened every movement of discontent, and gave strength to his administration. The easy victory over Spain increased the Republican majorities in the congressional elections of 1898. There was no doubt of McKinley's renomination in 1900, and he was eagerly named at a convention in Philadelphia. With him (for Hobart had died in office), Theodore Roosevelt, governor of New York, was nominated and elected vice-president. The Democrats renominated Bryan to run against them, but the issue that had made Bryan strong in 1896 was weak in 1900. He did what he could to impress on the country the dangers of imperialism, and the ills that would come to the United States if it assumed dominion over foreign peoples. The anti-imperialists opposed expansion of the United States beyond its continental limits as being contrary to the Declaration of Independence and the principles on which the nation was founded. One of the best Republican slogans was "four years more of the full dinner pail."

The people voted to retain the Republican party and its candidates, and the second term opened smoothly upon a prosperous country. McKinley was broadening his vision as he faced the problems of business and foreign affairs. In September 1901, at the Pan-American Exposition at Buffalo, N. Y., he spoke of the possible need to consider foreign trade in connection with the tariff, and hinted at a modification of the policy of high protection. Next day, the afternoon of September 6, while he was meeting hundreds of people in a public reception, an anarchist, Leon Czolgosz, approached among the many guests and shot him down. The murder was the whim of a cracked brain, and had no such connection with politics as had the murder of Lincoln by Booth, or Garfield by Guiteau. And eight days later, by the death of McKinley, Theodore Roosevelt became president.

MADAGASCAR (*măd-ȧ-găs′kȧr*). About 240 miles off the coast of southeastern Africa lies Madagascar, the fourth largest island in the world. Because it is remote from the centers of civilization and contributes little to world trade, the island attracts few visitors, except the French, who administer it as an Overseas Territory of the French Union.

Because many of its animals, plants, and rocks resemble those of Africa, some think that Madagascar was at one time connected to that continent. But it has also plants and animals seemingly of East Indian origin. This is the basis for supposing it to be a remnant of a continent called Lemuria, which is believed to have filled, in ages gone by, the central basin of the Indian Ocean. The natives, called Malagasy, are not related to the Negroes of nearby Africa, but seem to be of Malayan, Polynesian, and Melanesian stock. No one knows how or when they first came here.

Madagascar is 980 miles from north to south and has a maximum width of 360 miles. Its area, estimated at about 227,700 square miles, is nearly twice the size of Arizona. The great island lies almost entirely within the tropics and has rainfall the year round, with a rainy season from October to March. A backbone of mountains stretches the length of Madagascar dropping abruptly on the east to the Indian Ocean and sloping gently on the west to the Mozambique Channel.

The east coast is covered with dense tropical forests. Among the central mountains are large plateaus resembling the savannas of Africa, with scattered trees and jungles of long grasses. The largest and least-known region is the great plain to the west. It is hotter but less moist than the eastern coast, and has both prairies and forests. The southwest coast is flat, sandy, and arid.

Small animal life abounds in all parts of the island. There are no large native mammals and no

MADAGASCAR NATIVES AND A TWO-STORY MUD HUT

A native ascends to the cramped thatched-roof loft of his dried clay house either to eat or to sleep. For protection and privacy he pulls up the ladder. On the comparatively cool and roomy ground floor he keeps his live stock and his grain. The woman pictured here is a city dweller. The stalwart young man with the warrior's spear is a shepherd.

true monkeys, but Madagascar is the home of the small monkey-like lemurs (*see* Lemurs). The largest carnivorous animal is the *foussa*, a catlike relative of the civets, as big as a shepherd dog. Remains are found of a gigantic bird called the *aepyornis* that lived here until two centuries ago. It was over nine feet tall and laid an egg with a capacity of two gallons. It could not fly and resembled the extinct moa of New Zealand.

The Malagasy live in tribes in scattered villages. The coastal tribes build bamboo houses set on piles. In other places huts are made of dried clay with thatched roofs. Fiber mats are almost the sole article of furniture. The native dress is a loincloth for men and a sort of apron for women, covered over with a square white cloth, called a *lamba*, which is worn in somewhat the fashion of the ancient Roman toga.

The chief occupation is agriculture. The Malagasy are indolent and like to limit their work to the cultivation of rice, their principal food, and the care of their numerous zebu cattle, originally imported from eastern Asia. But the taxes imposed by the French compel them to labor on plantations where are grown coffee, manioc, vanilla, cloves, and plants that provide essential oils. These, together with dried beans and peas, preserved and frozen meats, hides and skins, are exported chiefly to France. Madagascar's mineral resources are rich but little exploited.

Lack of good transportation makes commerce within the island difficult. Good motor roads are few, and altogether there are only 500 miles of railways. The principal line runs from Tamatave, the chief seaport, to Tananarive, the capital, which is situated in the mountains a hundred miles from the coast.

There are about 16,000 miles of roads, many of them only trails. Few rivers are navigable beyond a short distance from the coast.

Although the Arabs had visited Madagascar before the 9th century, it was unknown to Europe until the Portuguese discovered it in 1500. The French and Dutch followed the Portuguese during the 17th and 18th centuries, but their attempts to establish permanent settlements failed. By the 19th century, the most civilized tribe on the island, the Hovas, were ruling the other tribes and began diplomatic negotiations with foreign nations, chiefly France and Great Britain. The French landed troops in 1883 and gained complete control in 1896.

During the second World War, the British for a time occupied the island. This prevented axis submarines and surface vessels from using the big naval station at Diego-Suarez and other ports as bases against United Nations shipping. Population (1952 census), 4,463,801.

MADEIRA (*mȧ-dē′rȧ*). The traveler who approaches the Madeiras, a small group of rocky islands belonging to Portugal, 360 miles off the northwest coast of Africa, gets his most picturesque impression when his steamer enters Funchal, the chief port and capital city of the island which gives its name to the group.

Natives—chiefly of Portuguese descent with some Moorish or Negro intermixture—noisy dark-skinned fellows, some wearing the "carapuça," a small blue funnel-shaped cap, surround the vessel. Their small boats are filled with wares such as cane chairs, basket work, red bananas, pineapples, custard apples, pomegranates, and other tropical fruits, and sometimes beautiful lace and embroidery. Others, swarthy and half-naked, plunge from their canoes into the water after the coins tossed them by the passengers. Within the city one sees, among other strange sights, wooden sledges and cars on runners drawn by bullocks, for in the Madeiras wheel carriages are rare.

Madeira is a rocky island of volcanic origin, 35 miles long and 12 miles wide, with a few scant forests, deep narrow ravines, and lofty rugged peaks (4,000 to 6,000 feet high) often covered with snow. Bold precipices rise abruptly from the coast and in parts the scenery is wild and beautiful. The climate is mild and uniform, and the island is noted as a health resort, especially for persons suffering from diseases of the chest. The absence of rain during the summer and the rocky and hilly nature of the land have made cultivation difficult.

The two staple products are sugar and a wine that is world famous. Vegetables and a variety of fruits are grown—apples, pears, and peaches of poor quality, oranges, lemons, grapes, guavas, figs, bananas, and pineapples, the last two forming articles of export.

Besides the island of Madeira, one other of the group, Porto Santo, is inhabited. The Madeiras are supposed to have been known to the Phoenicians in ancient times and were rediscovered by a Portuguese explorer in 1419 and colonized about 30 years later. Because of their location they played an important part in the early explorations down the west coast of Africa. Madeira is today a port of call for steamers between Europe and South Africa. Area, 314 square miles; population (1950 census, preliminary), 269,179.

MADISON—"FATHER *of the* CONSTITUTION"

MADISON, JAMES (1751–1836.) When Martha Washington heard of Dorothea Todd's engagement, in 1794, to Congressman Madison, she said, "Dolly, you pretty minx, make this bachelor better known and more popular." Dolly did both. She didn't know as much about books as did her scholarly husband, but she did know how to get him into society, and to win countless friends for him by her kindness as well as by her tact. Washington Irving describes her plump beauty as a marked contrast to her husband's small feeble figure and wizened face—for Madison was "a small man, quiet, somewhat precise in manner, pleasant, fond of conversation, with a certain mixture of ease and dignity in his address."


JAMES MADISON

Madison, like Washington, Jefferson, and Monroe, was a Virginian by birth. His father owned the large estate of Montpelier, in the then frontier county of Orange. But though possessed of many acres, the Madison family did not belong to the aristocracy or "first families" of Virginia. The family funds, however, were sufficient to provide a good education for James, the eldest son. When he was 18 he entered the College of New Jersey (which later became Princeton University). He graduated in 1771 and stayed another year to study Hebrew, history and government of ancient civilizations, and the principles of law.

At that time he intended to enter the ministry. But politics—a pursuit for which he was eminently adapted — soon claimed his attention; and from 1776 to 1817, with the exception of about four years, he served continuously in public office. In that time he was a member of the Virginia Assembly, of the Continental Congress, and of the House of Representatives under the new constitution. He had been a member of the convention which framed the constitution of Virginia in 1776, and was one of the leaders in the Constitutional Convention in Philadelphia, in 1787, which framed the Federal Constitution.

Indeed, Madison's chief claim to fame is the work which he rendered in connection with the formation

THE TREATY OF GHENT ENDS THE WAR OF 1812

Lord James Gambier, chief British commissioner, and John Quincy Adams, head of the American delegates, are shaking hands after the signing of the treaty. Behind Adams stands Albert Gallatin. The man with white hair and boots is James A. Bayard. Sitting in the chair is Henry Clay. This painting, which hangs in the Department of State, is by Adolphe Forestier.

and adoption of that Constitution. He had no sooner entered the Continental Congress, in 1780, than he saw that the national government needed more power. He worked for this both in Congress and in the Virginia Assembly, to which he returned in 1784 for a second term; but it was impossible to accomplish anything under the old Articles of Confederation.

When the Philadelphia Convention was called in 1787 to revise the Articles, Madison drew up a plan for a new form of government. This scheme, modified in some details, was introduced into the convention as the "Virginia Plan," and on it the new constitution was based. For this work and his other services in that connection, Madison is known as the "Father of the Constitution." In the convention he spoke more frequently than any other member, except Gouverneur Morris and James Wilson. Furthermore, he took careful notes of all proceedings, and this journal, published by order of Congress after the death of all members of the convention, is our most precious source of information concerning the proceedings of that body, which took place in the most profound secrecy.

Madison's work did not stop with the formation of the Constitution. With Alexander Hamilton and John Jay, he wrote a series of essays explaining the new instrument of government and giving reasons for its adoption. These essays, which appeared first in newspapers and later were published in book form, under the title of 'The Federalist', secured many converts for the Constitution, and remain today one of the best commentaries on the work of the "Fathers" who established the government.

Madison hurried home from the Constitutional Convention to secure election to the Virginia state convention, to which the Constitution would be submitted for ratification. In this convention he vigorously opposed the aged Patrick Henry, who thought that the rights of the people would not be secure under the new form of government. In spite of the strong opposition of the Anti-Federalists, Madison finally triumphed and Virginia ratified the Constitution.

But Madison evidently thought that there was some justice in the arguments of the Anti-Federalists, for in the newly organized House of Representatives, which he entered in 1789, he became the leader of Jefferson's party favoring strict construction. In 1798, also, while in retirement, he wrote the famous Virginia Resolutions, adopted by the legislature of that state, which condemned the repressive alien and sedition laws passed by the Federalists, and claimed that a state could "nullify" an act of Congress.

With the accession of Jefferson to the presidency, in 1801 Madison became secretary of state. Since Mrs. Jefferson was dead, it fell to the lot of pretty

"Dolly" Madison, his wife to act as hostess at the president's official dinners. She won many friends for Madison. Her popularity, Jefferson's political support, and Madison's own character and ability were the combination that won him election as the fourth president in 1808. His electoral vote was 122 as against only 47 cast for Charles C. Pinckney, the Federalist candidate. George Clinton of New York, who had been vice-president in Jefferson's second term, was re-elected vice-president.

The work of setting up the government and giving it the needed strength had been successfully accomplished under Washington's administrations. Then a democratic trend had been given to it by Jefferson; so Madison did not have to deal with these fundamental problems. But the shadow of war hung over his whole term of office. His first years were occupied with the disputes with England and France, which culminated in 1812 in a declaration of war against England (*see* War of 1812).

Madison, with Elbridge Gerry of Massachusetts as the candidate for vice-president, was re-elected in 1812 over De Witt Clinton of New York, the Federalist candidate, by 128 electoral votes to 89.

It must be admitted that Madison's administration of the war was far from efficient. He was hampered both by his own lack of ability as an executive and by the violent opposition to the war of the New England Federalists. This group in December 1814 met in secret in the famous Hartford Convention, and was suspected by some of planning New England's secession from the Union.

MADISON'S ADMINISTRATIONS
1809–1817

Harrison defeats Indians at Tippecanoe (1811).
Re-charter of United States Bank refused (1811).
Louisiana admitted (1812); Indiana (1816).
Continued aggressions of England and France lead to war with England (1812–15).
Re-election of Madison on war platform (1812).
Perry's victory on Lake Erie (1813).
Washington burned by British (1814).
Jackson crushes Creek Indian uprising (1814); defeats British at New Orleans (1815).
Treaty of Ghent leaves question of impressment unsettled.
Hartford Convention (1814) leads to fall of Federalist party.
Second United States Bank chartered (1816).
Mildly protective tariff passed (1816).
Policy of federal aid to "internal improvements" begun (1816).
Monroe elected president (1816).

The End of the Federalist Party

With the peace of Ghent (Dec. 24, 1814), this opposition collapsed, and the charge of disloyalty against the Federalists caused the death of their party. In spite of the fact that there was only one political party and that that party in theory favored strict construction and states' rights, various nationalistic tendencies developed during Madison's administration. These were shown in the new protective tariff law and in the chartering of the second Bank of the United States, both in 1816.

In 1817 Madison retired to his estate at Montpelier, where his efforts as a planter were no more successful than were those of his friends, Jefferson and Monroe. Like them he was interested in education, and he served with them as a regent of the University of Virginia, to which he left his library after his death.

MADISON, WIS. Wisconsin's capital, Madison, owes its beauty to its location on rolling land bounded by five lakes. Its importance springs from the presence of government agencies, a surrounding dairying region, industry, and the University of Wisconsin. Madison's business district occupies a seven-block-wide isthmus between Lakes Mendota and Monona. The granite capitol dome rises from a hill near the western end of the isthmus and is visible from all approaches to the city. Madison's pleasant, tree-lined streets spread along the shores of the two lakes forming the isthmus, southeast to lakes Kegonsa and Waubesa, and southwest to Lake Wingra.

Madison is a vacation center. Its industries include machinery and tool factories, meat-packing plants, breweries, and battery factories. The United States Forest Products Laboratory works in coöperation with the university and the lumbering industry.

The university campus extends a mile along the southwestern shore of Lake Mendota. The agricultural college has additional large areas devoted to experimental farms. Among the university's fine buildings are Memorial Union—a social center with many recreational facilities and a theater—and the Library, which houses the state historical society. Here also is Edgewood, a Roman Catholic college for women. Most of Madison's more than 800 acres of parkland occupy shorelands along the five lakes.

Early Wisconsin settlers considered the Madison area unsuited to settlement. But a federal judge, James Duane Doty, thought it the site for a capital, and in 1836 he persuaded the newly formed legislature of the Territory of Wisconsin to select it. The first settlers came in 1837; they opened a school the next year. Madison was named for President James Madison. It was incorporated as a village in 1846 and chartered as a city in 1856. Madison is the seat of Dane County. In 1950 the city adopted a mayor-council government. (*See also* Wisconsin.) Population (1950 census), 96,056.

MADONNA. The Italian word Madonna ("my lady") has come to mean Mary, the mother of Jesus. It refers to her especially as the subject of works of art. Crude figures of her appear on the walls of the catacombs. Early Byzantine artists usually painted her alone, a stiff little figure clad in a blue robe starred or slashed with gold, arms stretched up in prayer.

But after the Council of Ephesus in 431 upheld the doctrine that Mary was the mother of God, artists usually showed her holding the Infant Jesus. This sub-

ject of Mary and the Child became one of the most popular in Christian art, reaching its height in the brilliance of the Renaissance.

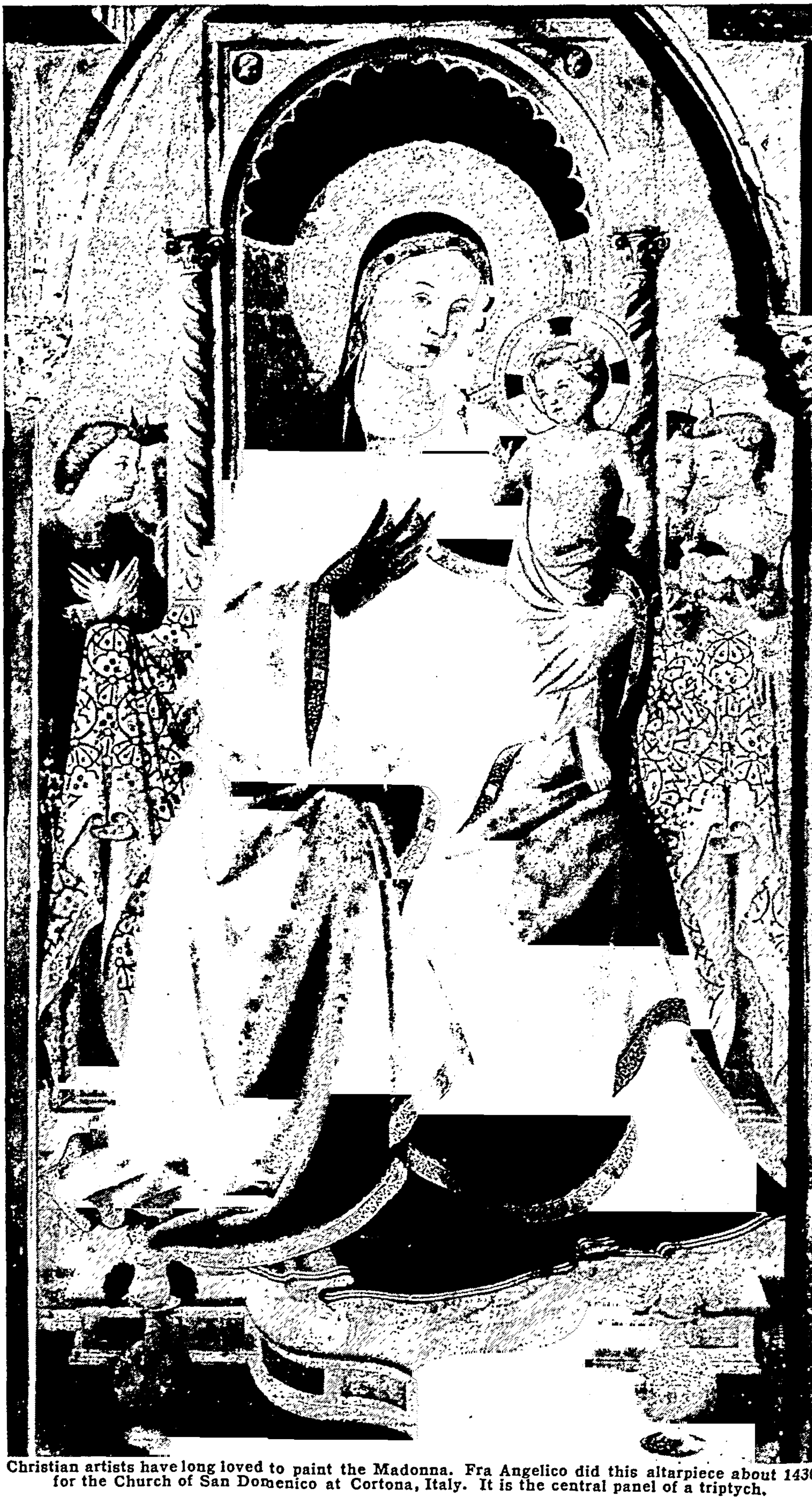
When Italian artists of the 13th century parted from the Byzantine style, the Madonna became more natural and beautiful. Then Fra Filippo Lippi discarded even the traditional gold backgrounds and painted lovely lifelike pictures of the Madonna and Child. *Magnificent Madonnas* were also painted by Bellini, Botticelli, Titian, Correggio, del Sarto, da Vinci, and Murillo.

But it was the gentle Raphael who most devoted his art to Madonnas. He painted scores, including two of the most celebrated. They were 'The Madonna of the Chair' (Madonna della Sedia) and the great 'Sistine Madonna'.

Sculptors too have presented the Madonna memorably. Perhaps the finest examples are two works by Michelangelo. One is the 'Madonna of Bruges', in the Bruges cathedral. The other is his lovely and poignant 'Pietà' in St. Peter's.

The Catholic church has encouraged the devotion to Mary, which tends to honor motherhood and all womankind. A prayer to her, the "Ave Maria" (Hail Mary), came to be coupled with the Lord's Prayer. Many shrines for "Our Lady" have risen, such as that at Lourdes in France (*see* Lourdes). Hymns, such as 'Stabat Mater' (The Mother Was Standing), have been composed in honor of Mary.

MADONNA AND CHILD PAINTED FOR AN EARLY CHRISTIAN CHURCH



Christian artists have long loved to paint the Madonna. Fra Angelico did this altarpiece about 1430 for the Church of San Domenico at Cortona, Italy. It is the central panel of a triptych.

MADRAS (*ma-drăs'*), INDIA. The roaring surf of the Bay of Bengal beats against the coastal plain of Madras, the major southern state in the Republic of India. The state's capital is also called Madras.

The state of Madras is not like the torrid, colorful region along the Ganges. Madras stretches along two thirds of southeastern India. A broad, sandy coastal plain reaches back to a long, sprawling range of hills called Eastern Ghats ("steppingstones").

How the People Live

Madras is thickly populated. Over two thirds of the people farm. Most of them are poor and they have only primitive tools. Oxen drag their crude plows. The people work long hours to make the dry plain grow rice, millet, peanuts, tobacco, and some cotton, jute, and sugar cane. They depend on irrigation, chiefly from the giant dam on the Cauvery River at Mettur. The farmers anxiously watch their irrigation storage tanks, for dry years bring famine. Along the coast coconut plantations make a green fringe. Sheep crop the drab foothills. Forests high in the Ghats yield teak and other fine hardwoods.

Poorly paid miners work rich deposits of manganese and sheet mica. Iron deposits are not mined extensively, since coking coal is not available for smelting. Along the coast, salt is evaporated from sea water and men in small craft fish for pearls.

The population of Madras state was 57,016,002 in the 1951 census, and its area 127,790 square miles. In 1953 a large area along the northeast coast where the people speak the Telegu language was made into a separate state called Andhra. Its population is estimated at 20,000,000.

City of Madras, India's Third Largest

The shallow, surf-lashed coast of the state of Madras has no good natural harbors; but engineers mastered the breakers at the city of Madras by building an artificial harbor. Today it is a major port and the third largest city in the Republic of India.

Madras grew from a fortified trading post built by the East India Company. In 1640 the company got a grant of the site from a native ruler and built Fort St. George. An increasing number of Indians came to live in the shelter of the fort's walls. In the 18th century the French twice attacked the fort.

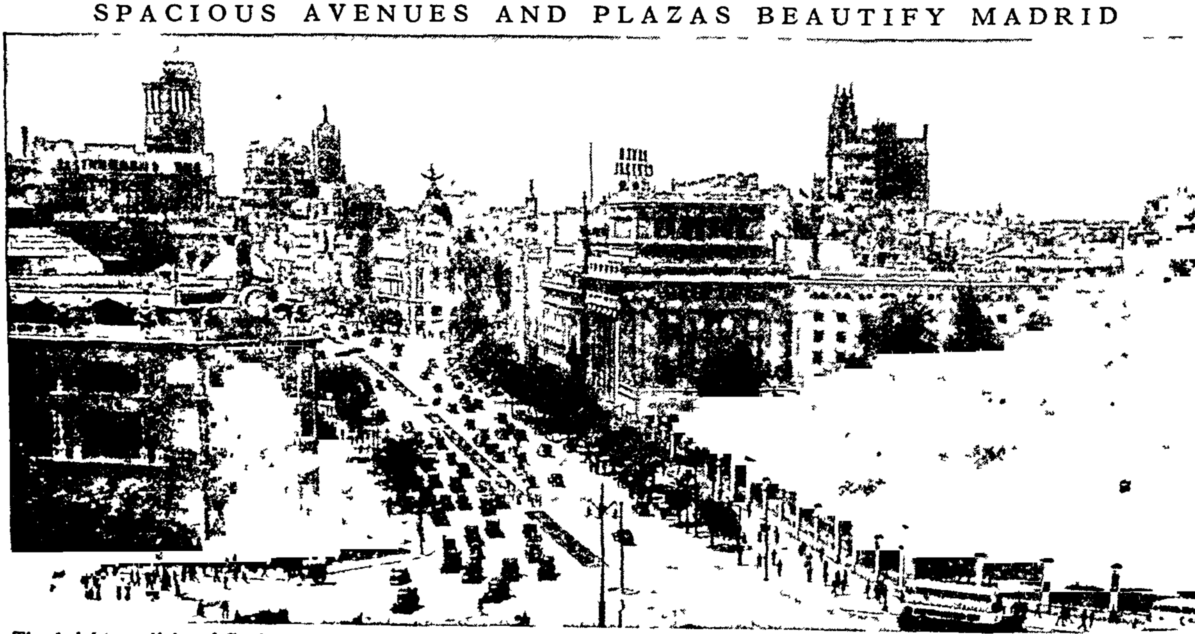
Industry and Appearance of Madras

Today Madras is essentially a workaday city. It is the manufacturing and transportation center of the state of Madras. The industrial districts are sprawling masses of dye factories, rice and cotton mills, sugar refineries, tanneries, brickworks, and railroad shops. The government also has a large quinine factory here. Madras exports large quantities of leather and hides. The cotton cloth called *madras* was first made in a nearby village.

Madras and its suburbs stretch about ten miles along the sea and some four miles inland. A small stream, the Cooum, flows through Madras. The sprawling city has many places of beauty. Homes of the well to do stand in the quiet of compounds, which are walled grounds planted like lovely parks. Cathedrals, Hindu temples, and public buildings are imposing. A splendid motor drive, the Marina, rims the sandy beach. Here in the late afternoon European residents and wealthy Indians drive to enjoy "the doctor," the sea breeze which tempers the heat. Madras University, founded in 1857, is handsome and stands high in educational work. Population of Madras (1951 census) 1,416,056.

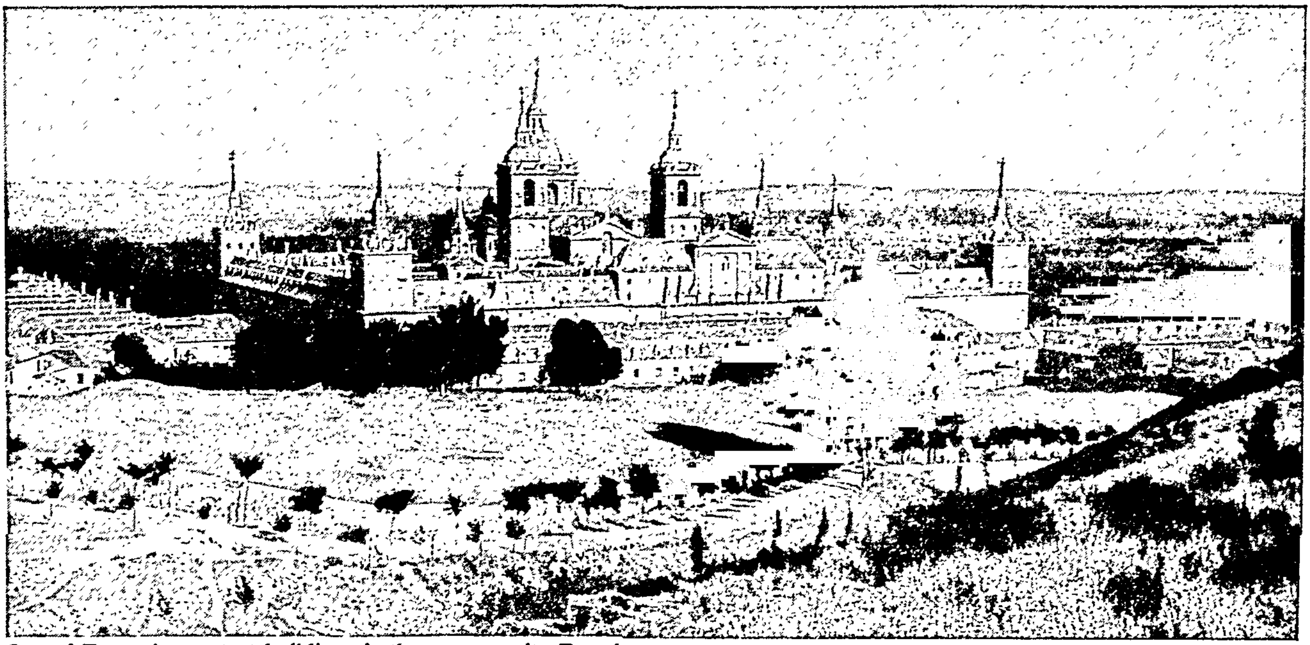
MADRID, SPAIN. Handsome Madrid, Spain's capital, rises from a windswept, treeless plateau of red clay, yet its location is important. In 1560 Philip II

SPACIOUS AVENUES AND PLAZAS BEAUTIFY MADRID



The bright sunlight of Spain glitters over the Calle de Alcalá, one of Madrid's principal streets. In the foreground is the Plaza de Castelar. Horse-drawn carts, which are still important in Spain's transportation, mingle with automobiles and buses.

THE GREAT TOMB AND SUMMER PALACE OF SPANISH KINGS



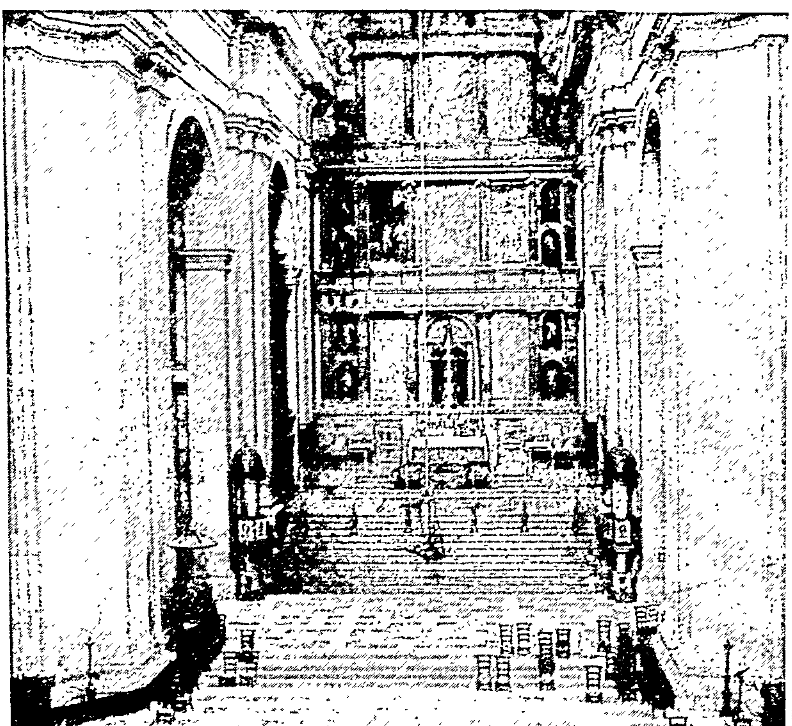
One of Europe's greatest buildings is the gray granite Escorial on the scraggly slopes of the Guadarrama Mountains, about 30 miles northwest of Madrid. Philip II of Spain built it (1563–84), dedicating it to St. Lawrence. The giant structure contains a palace, church, monastery, royal mausoleum, and 14 patios. The corner towers rise to eight stories.

visited a lonely sun-baked village almost in the center of Spain. He saw the political advantage of the central location and made the village the national capital. Today it is the hub of Spain's transportation and communication.

Madrid stands at an altitude of some 2,000 feet. It gets very little winter rain and is dusty dry in summer, but breezes from the Guadarrama Mountains to the north cool the evenings. In winter the blasts are cold. On any day of the year temperatures may vary as much as 50 degrees.

Madrid is one of the largest and most imposing cities in Europe. It is also one of the most crowded. The poorer sections are dirty and evil-

GRANDEUR WITHIN THE MIGHTY STONE ESCORIAL



At the left is one of the 40 or more altars in the enormous church housed by the Escorial. The small size of the chairs indicates the great height of the granite pillars. Rich paintings and figures of marble and gilded bronze enhance the massive beauty. At the right is a tapestry designed by Goya, one of Spain's master painters. It hangs in an Escorial gallery.

smelling. But the churches, historic buildings, and public structures are spectacular. Office skyscrapers give Madrid the highest sky line in Europe.

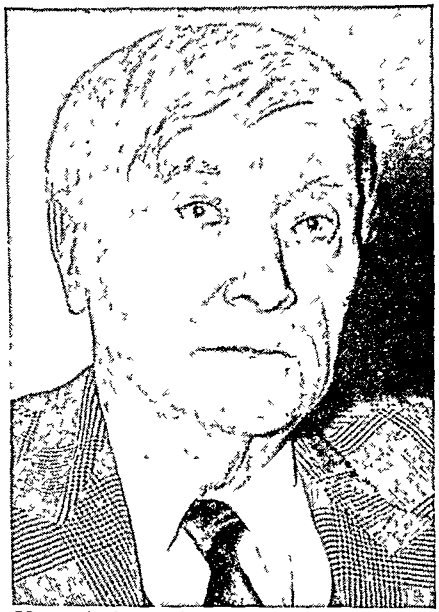
Madrid's heart is the *Puerta del Sol* (Gate of the Sun). From this plaza radiate the busiest streets. Many are broad, landscaped, and lined with chairs, benches, and outdoor cafés. Shops close every afternoon for three hours, but Madrid's people do not dine until between 8:30 and 10:30 at night. At dawn, two-wheeled oxcarts creak into the city with farm produce.

East of the great *Avenida de la Libertad* (Avenue of Liberty) is the largest of Madrid's parks, *El Retiro* (The Retreat). Beyond is the bullfight ring. Here thousands of *aficionados* ("fans") cheer their favorite matadors. On Madrid's outskirts stands University City, with its many colleges. Some 30 miles northwest looms the Escorial. It was both summer palace and tomb of Spanish kings.

During the Spanish Civil War (1936–39) Madrid was the Loyalist stronghold. It suffered heavy shelling and air attacks.

Madrid's manufactures include furniture, pottery, and chemicals. Other products are leather and cork. But it is chiefly an administrative center. Population (1950 census), 1,618,435.

BELGIAN MYSTIC



Maeterlinck sought to reveal mysteries that lie beneath the surface of everyday lives. The adventures of Mytyl and Tyltyl, in his famous play 'The Blue Bird', are spiritual adventures. He wrote in simple language and used symbols that are easily understood.

MAETERLINCK (*mä'tẽr-lĭnk*), **COUNT MAURICE** (1862-1949). About the beginning of the 20th century, Maurice Maeterlinck, a Belgian writer, attracted world-wide attention. Some critics hailed his work as founding a new era in writing; others called it foggy nonsense; but no literary person ignored him.

The incidents in Maeterlinck's writings were fanciful and dreamlike; his characters were pale, almost ghostlike. But the reader felt that he was seeing the soul, rather than the outward shell of flesh and blood. The whole effect was to send the reader's thoughts wandering freely through a world of fancy.

Such mystical writing might not have been so widely popular, had not a French critic, Octave Mirbeau, suggested that Maeterlinck's first play was "superior in beauty to whatever is most beautiful in Shakespeare." This remark immediately gave Maeterlinck fame as "the Belgian Shakespeare."

Maeterlinck's mysticism is partly explained by his early life. He was born in Ghent, Belgium, Aug. 29, 1862, the son of a well-to-do lawyer; no poverty disturbed his naturally dreamy turn of mind. His mystical tendency was strengthened in 1887, when he lived in Paris and met many French symbolist poets—men who tried to arouse feelings and emotions with words as a musician does with sounds.

Maeterlinck was educated for the law but he did not like it; and soon after his father died, he turned to writing. His first works appeared in 1889. One was a group of poems called 'Serres chaudes' (Hothouses); the other was the play, 'Princess Maleine', which Mirbeau praised so highly. In these and other early works, Maeterlinck showed a somber belief that people are moved by fate, like marionettes in a puppet show. Hence some critics call his early characters lifeless puppets. This phase of his writing reached its climax in the play 'Pelléas and Mélisande'. The two lovers in this play were too shadowy for successful portrayal on the stage, but became favorites in an opera by Debussy (*see* Opera).

'The Blue Bird'

After this play, Maeterlinck developed a happier mood which resulted, among other works, in his charming play, 'The Blue Bird'. A woodcutter's children, Mytyl and Tyltyl, want a blue bird. The fairy Berylune gives them a magic diamond, and they start searching.

They meet the souls of Fire, Light, and many foods; they visit the realms of Memory, of Night, and of the Future. But no blue bird can be found. At length they return home, and a neighbor asks Tyltyl if he will lend his pet dove to comfort a sick child. Tyltyl does this, and the dove becomes a blue bird. As the play ends, we realize that the Blue Bird is Happiness, and that happiness is best found at home, through acts of kindness. Though it seems simple, the play is full of hidden meaning.

Other Writings and Later Life

In addition to plays and poems, Maeterlinck wrote many essays, more or less mystic in character and poetic in expression. Among the best known are 'The Treasure of the Humble' and 'The Life of the Bee'.

Maeterlinck's writings made him rich, and he bought an old Norman abbey near Rouen for a home. His first wife was the actress Georgette Leblanc, who appeared in many of his plays. After a divorce, he remarried and lived near Nice. He was awarded the Nobel prize for literature in 1911, and was made a Count of Belgium in 1932. Unlike many modern Belgian authors, who write in Flemish, he always wrote in French.

His chief plays are: 'La Princesse Maleine' (1889); 'Les Aveugles' (The Blind), 1890; '*Les sept princesses*' (The Seven Princesses), 1891; 'Pelléas et Mélisande' (1892); 'Soeur Béatrice' (Sister Beatrice), 1899; 'Monna Vanna' (1902); 'L'Oiseau bleu' (The Blue Bird), 1909; 'Le Bourgmeistre de Stilemonde' (The Burgomaster of Stilemonde), 1918. Among his other works are: 'Serres chaudes' (Hothouses), 1889; 'Le Trésor des humbles' (The Treasure of the Humble), 1896; 'La Vie des abeilles' (The Life of the Bee), 1901; and 'Le double jardin' (The Double Garden), 1904; 'La Mort' (Death), 1913.

OUR MAGAZINES—STOREHOUSES *of* FACT *and* OPINION

MAGAZINES. The field of reading matter that lies between newspapers and books is occupied by *what we call magazines.* There are hundreds of them and they are devoted to everything from the lightest humor to the most profound learning.

Magazines differ from newspapers in several ways. Magazines are usually published weekly or monthly; most newspapers are published daily or in several editions every day. Magazines deal with every subject under the sun; newspapers confine themselves mainly to the happenings of the day. Magazine articles have short titles; newspapers have elaborate headlines which are really "compressed sentences." Magazines are usually printed on fairly good paper, in small sizes, with specially designed covers; newspapers are printed on large sheets of very cheap paper, and American newspapers never have covers but plunge into the news on the first page.

Since the early 1920's, a new type of "news magazine" (half newspaper and half magazine) has developed in America and been imitated in England. This is not really so new as it seems, however, for it is a return to the little *Weekly Newes* published in London in 1622. Reprint magazines, which condense articles from other magazines, have also become popular. They too are a return to old-fashioned publishing. A hundred years ago, nearly all American magazines were of this sort, finding most of their material abroad. English reprint magazines were even older.

Supported by Advertising

Most magazines are business enterprises, run for profit, which they make by selling space to advertisers. Every copy may cost a great deal more to print and deliver than the subscriber pays for it; but if the magazine can win enough readers, advertisers are glad to pay high prices for advertising space. This makes up the loss and adds a profit.

Magazines are usually classified as "class," "mass," and "quality." *Class magazines* are those which appeal to a special group or class. Thus, a journal devoted to the drug trade will be read by druggists, a medical journal by doctors, a sporting magazine by sportsmen, and so on. Advertisers use such magazines when they want special audiences for special merchandise. No advertising in them runs the chance of being wasted on uninterested readers. (*See* Advertising.)

Magazines for boys and girls are class magazines. They appeal to a special age group. Advertisers know that young people will respond to advertisements of athletic equipment, clothing, games, insignia, and camp fixtures. They have also discovered that young people often influence their parents in family purchasing. That is why these magazines often advertise articles intended for the whole family.

Mass magazines are edited to appeal to everybody, young or old, no matter what his education or profession. They are valuable to advertisers who want to sell to everybody. Automobiles, radios, toilet articles, food, cosmetics, furniture are all called to the attention of the public in this way. Mass magazines with circulations of from half a million to three millions are so valuable to advertisers that they gladly pay several thousand dollars a page. They know they are getting their money's worth, because advertisements in a few such magazines will bring their wares to the attention of the whole nation.

Quality magazines are expensive and appeal to a group of readers limited in number but highly educated. Insurance companies, reliable stock and bond houses, and makers of pianos, high-grade furniture, and expensive automobiles advertise in them freely. The quality magazines almost monopolize book advertising, because their readers are booklovers.

The Riches Between the Covers of a Magazine

We get both recreation and education from magazines. A few issues of a good magazine often give us one or more serial novels, in addition to articles, poems, short stories, and special departments. Magazine articles stand midway between newspapers and books—they are more carefully prepared than the hasty reports of newspaper writers, and they have a timeliness lacking in the more mature expressions in books, which may be out of date before they can be published.

Years after publication, when they have been bound and put away on library shelves, magazines are still valuable as a permanent record of life, thought, and culture. They are storehouses of information, as the word implies, for "magazine" comes from an Arabic word meaning storehouse. They are a valuable source of material (often by the best authorities) for student themes and essays on every possible subject. In this immense mass of material, students can quickly find the articles they want by using four reference works—'The Readers' Guide to Periodical Literature', 'The International Index to Periodicals', 'The Industrial Arts Index', and 'Catholic Periodical Index'. They are available in libraries. They classify by author, title, and subject nearly every important magazine article published in English.

Relation to Public Opinion

Editors of magazines both follow and guide American life and opinion. An editor's main work consists in studying the taste of his public. By adjusting his magazine's contents to that taste he can keep his readers and make his magazine a success. Many student editors of school and college magazines forget this. Their magazines fail because they print what they themselves enjoy without considering what the school public wants to read.

But magazines may also lead their readers, instead of merely following them. Magazine campaigns have done much to end the sale of fraudulent patent medicines, improve architecture, promote good taste in interior decoration, "clean up" unsightly landscapes, clarify political issues, destroy corruption, popularize science, and in general guide the public mind.

How Articles Are Obtained

Would-be contributors flood magazine editors with enormous numbers of manuscripts. Even rather small magazines may receive from ten to forty thousand manuscripts a year. Perhaps two per cent are accepted. Most magazine articles are thought out by the editor, who then looks about for an author to carry out his idea. Student editors might improve their magazines by doing the same thing—thinking up some ideas of interest to their schools, and then finding suitable writers among their fellow students.

Beginning authors are sometimes paid nothing at all by the unimportant magazines that print their work. More frequently, they are paid $10 or $15 an article. Quality magazines pay from $50 to $500. The big mass magazines pay from $500 up to $2,000 or more. Successful fiction writers can command $1,000 or more for a short story and $20,000 or $30,000 for a serial novel. Often they later get large additional payments for motion-picture rights.

How American and European Magazines Differ

American magazines differ widely from those abroad. One main reason for the difference is their immense market. Including Canada, where they are just as popular as they are at home, American magazines can count on a very large reading public. Hence they have more money to spend. They can afford the finest typography and illustrations, and they can attract both European and American writers of the highest talent. Some are translated and published in various foreign languages, including even Arabic and Japanese. Magazines in other countries generally have less advertising and fewer readers. In some countries they are further handicapped by government censorship.

The First Magazines

Like newspapers, magazines are a late development in the history of literature. Newspaper and magazine publishing was impossible until printing had been invented, until there could be distribution by a modern postal system, and until there was a large reading public. Until the middle of the 19th century, only the wealthier people were educated and the reading public was small. And so magazines were not numerous and their circulations were limited.

As early as Queen Elizabeth's time, publishers had experimented with books that had a number of articles dealing with a variety of subjects. These books were like magazines with only one issue. It did not occur to their publishers to keep on bringing them out month after month. By 1699, however, one of the earliest magazines, *The History of the Works of the Learned*, a book review, had been established. During the 18th century numerous English magazines came into existence, such as *The Tatler* and *The Spectator* (*see* Addison, Joseph).

The English colonies in America soon began to imitate the publishers in the mother country. Benjamin Franklin was the first to plan an American magazine, but he was anticipated by Andrew Bradford, who started his *American Magazine* in 1741. Franklin followed with his *General Magazine and Historical Chronicle* in the same year. The reading public of the colonies was too small, however, and neither magazine lasted out the year. Few of the early magazines had more than 1,500 readers, or lasted very long.

Magazine publishing was a perilous business then and has always remained so. On the average, more than 300 magazines cease publication in the United States every year. Nevertheless, the total number averages between 5,000 and 6,000, as compared with about 13,000 newspapers. Some American magazines have had long lives. *The Saturday Evening Post* claims

DEATH OF MAGELLAN

He drove his lance through the nearest savage and lost the weapon. With his wounded arm he started to draw his sword, but a war club struck him down. Pigafetta, fighting by his side, tried in vain to save him.

descent from Benjamin Franklin's *Pennsylvania Gazette*. *Harper's* has been published steadily since 1850, *The Atlantic* since 1857, *Popular Science Monthly* since 1872, and *The Forum* since 1883. (*See* Newspapers.)

The best account of magazines in the United States is 'A History of American Magazines' by F. L. Mott, now out of print. Playsted Wood's 'Magazines in the United States' (Ronald, 1949) traces the economic and social influence of magazines since 1741.

MAGEL'LAN, FERDINAND (FERNÃO DE MAGALHÃES (1480?–1521). "The ocean! The great western ocean!" shouted the Spanish seamen, as their cannon saluted the mighty Pacific which they had been seeking for many weary months. "If we live we shall yet find the new way to the Islands of Spices!"

"Thank God our Lord!" exclaimed Magellan, their captain. "It is true, Señores, that we have lost two vessels, that our provisions are wasted, and that we may have many more hardships yet to endure. But even if we are reduced to eating the leather on our ship's yards, we will go on!"

This is the dauntless spirit shown by that Portuguese mariner who discovered the Strait of Magellan, and who was not only the first European to sail across the Pacific Ocean, but also the first to discover a route over which ships could sail a complete circle around the world.

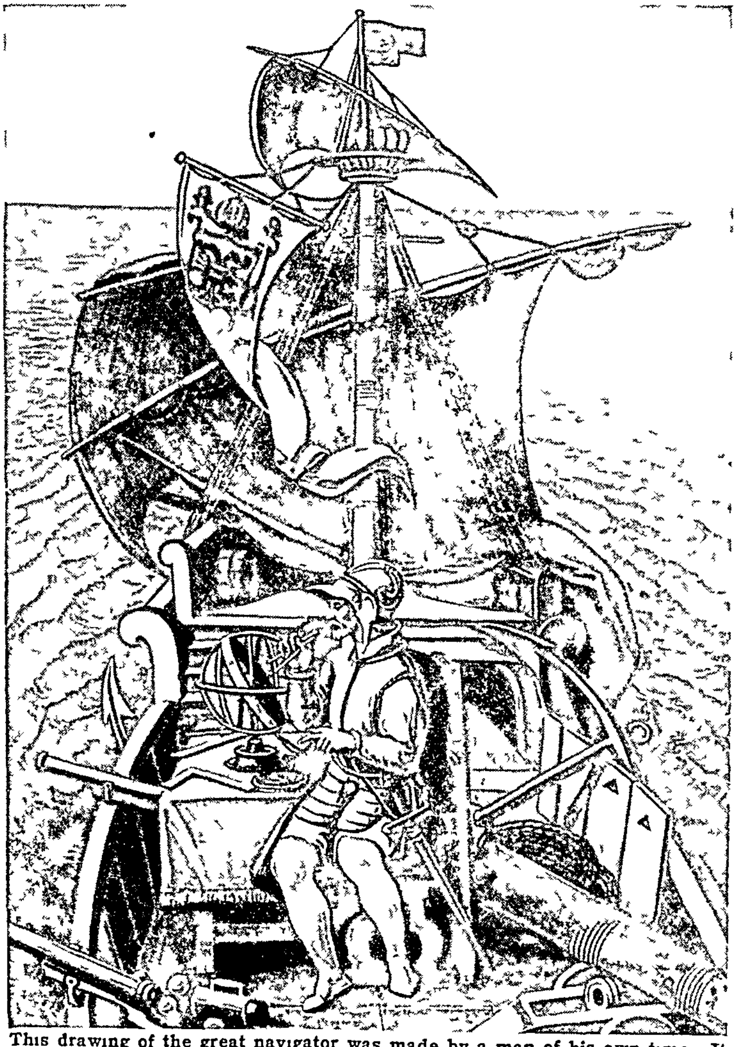
Magellan, the son of a Portuguese nobleman, early served in the Indies and Morocco with distinction. Believing his king had not justly rewarded his services, he renounced his nationality and offered to serve Charles V of Spain. At the time, Portugal claimed that all the islands of the Far East lay in the portion of the earth assigned to Portugal by Pope Alexander VI (*see* America). Magellan asserted that

many of them, including the fabulously rich Spice Islands, or Moluccas, actually lay in Spain's territory, and that the Portuguese maps had been falsified to conceal this. He offered to use his knowledge of Portuguese secrets to prove his assertion, and proposed to reach the Spice Islands by sailing west through a strait which he hoped to discover at the southern tip of America. The Spanish king finally accepted Magellan's proposal, and on Aug. 10, 1519, the latter set sail from Seville in command of five small vessels. Across the Atlantic and down the coast of South America he sailed until very cold and stormy weather forced him to seek winter quarters. A mutiny was put down by force.

Sailing on again in the spring (which comes in September in the Southern Hemisphere), Magellan's fleet rounded a promontory and on October 21 sighted what he guessed to be the sought-for strait. Two ships went ahead and reported that the strait led to an ocean beyond; so the fleet proceeded. The "ocean" proved to be only a large bay in the strait; but at a council held with his navigators Magellan declared his purpose of going on. For over a month he battled his way through this stormy 360-mile passage. One vessel was wrecked and another stole away and sailed back to Spain; but still Magellan persevered. On Nov. 28, 1520, he reached the ocean that Balboa discovered seven years before, and which Magellan now—because it looked so calm—named the Pacific.

At first the voyage on the Pacific went well, save for monotony. A source of amusement was a Patagonian, whom Magellan had kidnaped with the idea of exhibiting him in Spain; and the chronicler of the voyage, an Italian named Antonio Pigafetta, even made progress in setting down the Patagonian language.

AN OLD PORTRAIT OF MAGELLAN

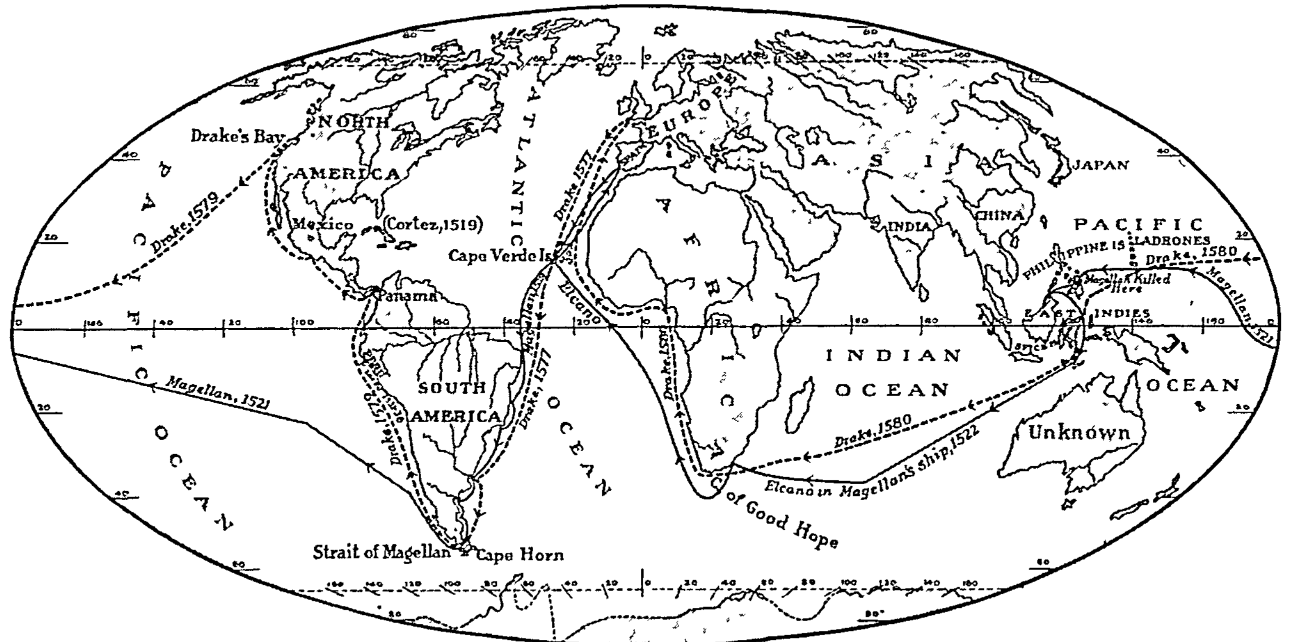


This drawing of the great navigator was made by a man of his own time. It shows him working with the quaint nautical instruments of the period, but the artist used his fancy freely in drawing the ship.

But after a month of sailing, terrible hardships assailed the fleet. The provisions ran low, and rats and leather were choice foods. The drinking water turned thick and yellow, and dozens died of scurvy. In all, the fleet sailed 93 days before discovering Guam of the Marianas, and a week later the Philippines. Magellan established friendly relations with the treacherous king of Cebu. This king professed Christianity in order to win Magellan's help in conquering the neighboring island of Mactan. It looked like an easy victory for Magellan's men, but because of the shallow waters around Mactan, they were unable to sail in close. Landing in small boats on April 27, 1521, they set fire to the native village. Infuriated and screaming natives charged with spears, clubs, bows and arrows, and even rocks. Magellan's men were driven into the water. Most of them climbed into the boats and fled. Only a handful remained with Magellan, fighting knee-deep in the sea. Pigafetta fought bravely to save his chief, but a club struck Magellan's leg and he went down. A swarm of natives quickly killed him. The king of Cebu afterward got into his power several members of the expedition and murdered them. The survivors burned one of the three remaining vessels and sailed to the Moluccas, or Spice Islands. Another vessel, becoming leaky, had to be abandoned. The last remaining vessel, the *Vittoria*, under command of Juan Sebastian del Caño, set out for home. Laden with spices, it rounded the Cape of Good Hope and in melancholy triumph dropped anchor in the harbor of Seville, Sept 9, 1522. It had circumnavigated the globe.

Contrary to popular belief, Magellan had also rounded the world before his death. On a previous *eastbound* voyage to the Indies, he had gone beyond

THE FIRST VOYAGES AROUND THE WORLD



This map shows the route taken by Magellan's expedition (1519–1522), and Drake's route, half a century later. Magellan was killed in the Philippines, and of his five ships, only the *Vittoria*, under Juan Sebastian del Caño, completed the voyage around the world.

the longitude of the Philippines. Thus, at the time when he was killed, he had already overlapped his earlier course.

In the history of discovery no name ranks higher than that of Magellan. He opened the Pacific Ocean to the civilized world. John Fiske, the American historian, says: "The voyage thus ended was doubtless the greatest feat of navigation that has ever been performed, and nothing can be imagined that would surpass it except a journey to some other planet."

CHARMS, SPELLS, *and* MAGIC INCANTATIONS

EVERY child knows wonderful stories of magic. Life would be dull indeed, if elves and fairies, giants and dwarfs, ogres and dragons were done away with. How should we see the beauties of Baghdad without the magic carpet, or the glitter of the robbers' cave without Ali Baba's "open sesame"? What would become of Aladdin without his wonderful lamp, or of Jack without his bean-stalk? What a gap would be left in King Arthur's court if Merlin, the great magician, were removed! As long as children glory in wonderful heroes and beautiful princesses, in little boys who conquer monsters and little girls who overcome wicked witches, we shall have seven-league boots, magic swords, wishing cups, purses of Fortunatus, mice turned into horses, and all the marvelous feats of fairyland. The literature of all races has been filled with tales of magic, from the 'Arabian Nights' to 'Peter Pan'. But these are fancies to delight a fireside evening. There is an entirely different side to magic, which has played an important part in nearly all primitive religions and which is dealt with in this article.

MAGIC. In primitive days, before science had provided its key to nature, men were surrounded by terrifying mysteries. They could fight their human enemies and overcome wild beasts, but the lightning which killed without warning, the strange diseases which struck men down at their own firesides, the swarms of locusts which devoured their grain, all such unusual disasters appeared to them monstrous and unjust — the products of *magic.*

The difference between magic and religion seems to have been clear even in those days. The general tendency was to believe that their gods ruled in an orderly manner, each looking after his own department and his own people, with perhaps a supreme god over the entire group. The spirits of magic, however, were considered irresponsible and disorderly. They caused accidents and trouble without reason. But the most important thing about them, according to savage belief, was that they could be brought under man's control and used for private purposes.

It is this belief, existing down through the ages, which created the thousands upon thousands of magic practises and superstitions, sometimes secret, sometimes carried on in public, but all with the idea of getting supernatural help against enemies or against the powers of nature. The spirits of magic, instead of being looked upon as gods, were often used to outwit divine authority.

Among the earliest forms of magic are those which rest upon the belief that the fate of an individual may be influenced by getting possession of something which once belonged to him. A lock of hair, nail clippings, a drop of blood might put the person from whom they came completely in the hands of the magician. This is still believed among the natives of the Pacific islands, among the Patagonians of South

America, and even in certain peasant districts of Germany. A bit of clothing stolen from an enemy was also considered a powerful agent of magic. The belief spread to include almost everything which had come in close contact with a man's body, so Australian savages drove sharp stones into a man's footprints to make him go lame.

On the other hand, the weapons or clothing of a man noted for courage may make a hero of the one who seizes them. The claws of a lion will bring the wearer the boldness of the king of beasts, the feathers of the eagle will give swiftness and keenness of eye. These beliefs even affect the food of the savages. Thus the flesh of deer or rabbit may create cowardice, but the meat of the lion, the tiger, the bull, give strength. Cannibalism in part was the outgrowth of such superstition.

Later came the belief that, by imitating the thing or person that he desired to influence, the magician could establish his control. Pretended "rain-makers" almost always sprinkled water, made smoke clouds, used flashes of fire to indicate lightning and wooden clappers to imitate thunder. Stones shaped like vegetables were buried in the soil to make real plants grow. American Indians drew the picture of an antelope on a piece of bark and shot at it with an arrow. If they struck the drawing, it meant that they would be lucky in their hunting.

It was the custom among many peoples to make figures of wax or clay, resembling the persons they wished to injure. Calling them by name, the magicians would thrust pins into the figures, or tear off an arm or leg, or melt them in fire or water; whereupon illness and death accompanied by great pain was supposed to come upon the person indicated. This practise prevailed in England and Ireland for many centuries and it is probably still used occasionally in isolated regions. It also exists today in the *voodoo* rites of the natives of Haiti, inherited from ancient African beliefs.

MAGIC RITES TO CURE ILLNESS

The sick man is lying down with his head in a relative's lap. The "medicine" is in the curved hollow horn lying over the patient's body, and the "witch doctor" is performing incantations to drive away the demons which the natives believe to be the cause of the trouble.

The power of names forms a branch of almost all magic. The name was considered as part of a man and, by pronouncing it under proper circumstances, he could be influenced for good or bad. From this belief grew the custom among many savage tribes of having two names for each individual—a real name, which was kept a careful secret, and an everyday title, through which he could not be influenced magically. Gods and spirits were believed to have special magic names, known only to a chosen few. Uttering these names was supposed to give a man some power over these supernatural beings. In this way grew up the spells and charms which form so large a part in the history of magic.

Charm-words or certain secret sentences called incantations were used for summoning the spirits of the dead, and all the various jinns and genii, goblins and fairies, who would then obey the orders of the one who possessed the secret. The belief in "putting spells on" hated rivals or other enemies existed in all countries and continues among the uneducated today. The theory of the curse is part of such a belief. Certain spells like the Irish *geasa* compelled the person addressed to carry out any reasonable task which might be demanded, under penalty of losing honor and reputation. Other spells, like the *tabu* of the Pacific islands, prohibited certain actions. A dwelling might be tabu, which would forbid anyone entering it under threat of magic punishment. Various animals or fish, fruits and vegetables might become tabu for certain members of a tribe and not for others. This tabu power was often used by native chiefs and priests in place of laws, and it was held in such terror that violations were exceedingly rare.

The word "charm" is also used to describe talismans, amulets, mascots, and any object which is carried to bring good luck. Almost anything may become a charm in this sense. Usually the person discovers the magic properties of the object himself,

The picture at the top shows a group of devil chasers in a New Guinea village, wearing fantastic masks to frighten away devils. Witchmen often get themselves up to look like the evil spirits. In this way they show their people how repulsive and terrifying are the fiends, from which they must be protected by magical rites. The lower picture shows a South African witch doctor speaking magic words into a patient's ear to drive out of his head the devil of sickness.

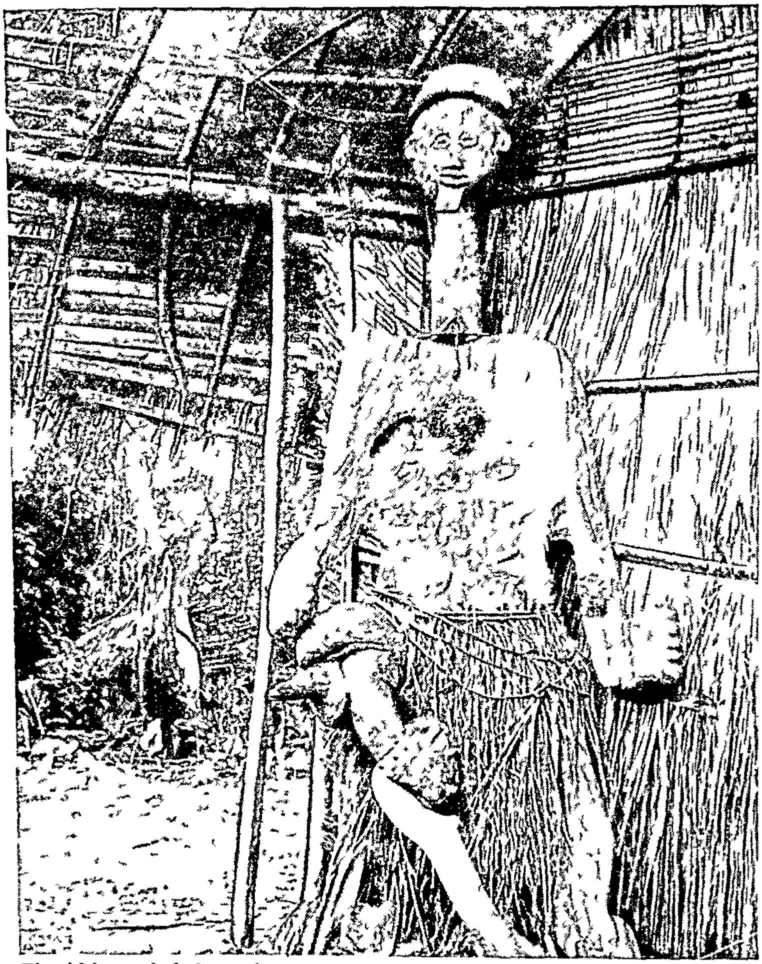
and while it may be a charm for him, it is often supposed to bring bad luck to any other person. The most general use of talismans and amulets is to guard against the "evil eye," the fear of which exists in one form or another in many parts of the world. Certain persons are believed to have this evil eye and to bring disaster to anything they gaze at, unless proper magic protection is provided.

When a charm is believed to be not merely an instrument of magic but the actual dwelling place of a certain spirit, it is called a "fetish." The worship of fetishes is usually regarded as a form of religion, but it has many of the characteristics of ordinary magic. Fetishism plays a large part in the voodoo practices mentioned above.

While most forms of magic are based on the belief that evil spirits are particularly numerous and likely to injure mankind, there arises also a belief in good spirits. Along these lines, the practice of magic came to be divided into black magic and white magic; the former being used to do harm, the latter to combat this harm and do good instead.

The special magician or sorcerer has existed wherever a belief in magic prevailed. Under the name of necromancers, wizards, witches, conjurors, medicine-men, soothsayers, diviners, and a hundred other titles, they posed as persons who had unusual powers over the spirit world, could foretell the future or read the secrets of the past. They were everywhere regarded by the people with fearful respect. In Christian countries persons suspected of dealing with the powers of evil were persecuted severely (*see* Witchcraft). But many of their practices were regarded as beneficial, even in Europe, in the Middle Ages and later. Studies in magic frequently led to important scientific discoveries, for the sorcerers in contriving their magic philters and other drugs made wide researches in chemistry, while those who studied the influence of the stars on human life learned many a valuable fact about astronomy.

THE WITCH DOCTOR'S "WATCH DOG"



The African witch doctor is away, and he has set up this grotesque image before his door. He has no fear that burglars will visit his establishment during his absence, for no native would be foolhardy enough to brave the mighty powers which he believes this image possesses.

In common practice, however, their so-called skill was directed toward interpreting dreams, getting information about the future from their "familiar" spirits, and, in almost all cases, deceiving a superstitious public for their own personal profit. Among the intelligent, their fraud was usually suspected, and it was the Roman Cato who "wondered how one diviner could meet another on the street without laughing."

While modern man prides himself on having thrown off all such superstitions, remnants of magical belief are found even among fairly intelligent people, and many of these are regarded seriously. Under this head come all the delusions about broken mirrors, walking under ladders, the number 13, Friday, lucky coins, spilling salt, wish bones, black cats, opals, and a thousand other things that are supposed to bring good luck or bad luck. Medical superstitions also remain too numerous to mention.

People still visit fortunetellers, crystal-gazers, and palm readers in the vain hope of knowing the future. Astrologers do a lively business casting horoscopes and advising people who mistakenly think that the stars influence their lives. Several almanacs continue to list the signs of the zodiac and give advice about planting crops and treating farm animals according to the positions of the heavenly bodies Most scientists look upon Ouija boards and many practises of spiritualistic mediums as relics of the magic arts

How Modern Magicians Mystify Their Audiences

Pulling a rabbit out of a hat, the classic trick of stage magic. The performer is John Mulholland.

THE FIRST magicians were primitive priests. In order to impress their tribesmen with the power of the gods, they would perform certain tricks which they had discovered. Savage medicine men, for example, pretended to remove, from the bodies of sick people, stones and other objects, which they claimed had been conjured into the invalids by unfriendly sorcerers. What they really did was to conceal the objects in their clothes when they went to call on sick people. If the invalid had any pain he would be asked to point out where it was. The medicine man would then secretly take the object from his clothes, hide it in his hand, and then pretend to pluck it from the painful spot. They had few tricks and they were all simple.

This priestly magic continued for thousands of years before there was any other kind of magic. Even today many savage tribes have magician priests. In civilized countries, too, men use magic tricks while pretending that they are able to foretell the future.

Origin of Magic Entertainment

What we mean by magic today, however, is a form of entertainment. The magician is an entertainer—an actor pretending that he can do the impossible. Modern magic does not come down to us from the work of the pagan priests, but from the traveling entertainers of the Middle Ages. There were musicians, storytellers, and acrobats, as well as magicians, among those gipsy-like strolling players. They performed in the castles for kings and nobility and in the market places for the common people. At first these magicians, too, knew but few tricks. The difference between them and the earlier self-styled sorcerers was that the magicians claimed no alliance with devils or pagan gods. They offered their magic merely as entertainment.

Little by little, during the centuries, magicians invented further feats. They wished to be thought wise and therefore called their performances "amusing physics" and "natural magic," and styled themselves scientists and "professors." Even during the last century almost all magicians were called "professors." In order to carry out their pose as scientists they used very complicated-looking, gaudily painted apparatus, and presented their tricks with the aid of magnetism, electricity, and other natural forces little known to their audiences.

Tricks Change as Science Spreads

Science and invention have gone so far in the last 75 years that many of the old tricks would now be laughable. Audiences were once tremendously impressed when a voice came out of a trumpet, which was swung on cords from the ceiling. Today audiences would imagine, though wrongly, that radio was used. It became necessary for magicians to give up most of their elaborate mechanical tricks and their scientific claims when everyone became used to having mechanical things around the home.

The way in which secret knowledge can be made into a feat of magic was shown by the explorer who fell among wild Indians. Some of the Indians were kind to him—they fed and protected him; some of them were unpleasant and hostile. To the friendly Indians he gave presents of common matches. To the unfriendly Indians he gave safety matches, which looked the same to them. Thus his friends got matches which would strike anywhere, and they were able to light their campfires without bow and drill or flint and steel. But his enemies could scratch until they were tired without getting a spark. Yet when they brought back their safety matches to complain about them, the explorer would strike the

STREET MAGICIAN OF NAPOLEON'S TIME

This old print shows a traveling magician performing simple tricks in a public square. Notice the apron with the large pocket, which was the badge of his profession.

matches on the box which he had kept, and give the Indians a lecture on the duties of hospitality.

The explorer was a magician to the Indians, but not to the people who were familiar with matches. To be a magician to civilized audiences, a man needs, besides his secret knowledge, three things: psychology (which in this case means knowing how to keep the audience from noticing all that is being done), skill of hand and body, and special apparatus. When he has these three elements, he can, with the proper acting, make them into magic. The true art of magic lies in the performance. The tricks alone are merely puzzles, and what makes them mystifying and entertaining is the way they are done.

The Psychology of Deception

Undoubtedly the most important factor is that the magician should keep the audience from noticing all he does. That is called the psychology of deception. If you are able to control people's attention, you can be a magician with little skill of hand and no apparatus.

For instance, you can start playing with a coin. Accidentally, you drop it on the floor. If you can imitate—convincingly—the familiar action of picking it up, no one will suspect that you have actually left it on the floor, even though you have not taken the precaution of stepping on the coin as you pretend to pick it up. Then a few moments later you can show that your hands are empty, and people will be vastly surprised that the coin has disappeared. Because you have done a perfectly natural act, the audience not only forgets that you have done it, but scarcely notices your movement at the time it takes place.

Another device is to make people look away from you during part of the trick. You merely call their attention to something at a distance. If this is done naturally and with a reasonable excuse, everyone will follow your suggestion. So long as the attention of the audience is fixed on something else, what *you* do will escape notice.

Distraction of the mind may be just as important as distraction of the eye. By this means the magician draws attention away from his method. If he is doing a mechanical trick, he talks about skill of hand, magic words—anything but mechanics. He tries to mislead the thoughts of the audience.

Robert Houdin, the great French "father of modern conjuring," provided a fine example of this when his government sent him to Algeria. His task was to discredit the tricks of the native priests (who kept encouraging rebellion) by showing tricks better than theirs. Among his favorite tricks was that of a wooden box with an iron bottom, which could be immovably stuck to the stage by turning on a strong electromagnet Houdin announced that he could make anyone, no matter how strong, as weak as water. He called on a powerful Arab and told him to lift the box, which the man did with ease. Then Houdin said that he would take the man's strength away with a magic word. The word, of course, was a signal to a helper to turn on the electromagnet. Then Houdin defied the Arab to lift the box The Arab wrestled until he was breathless, but he could not get it so much as an inch off the floor. From this the Algerians concluded that the French could bewitch them, and they fell away from their priests.

ROBERT HOUDIN'S HISTORIC TRICK

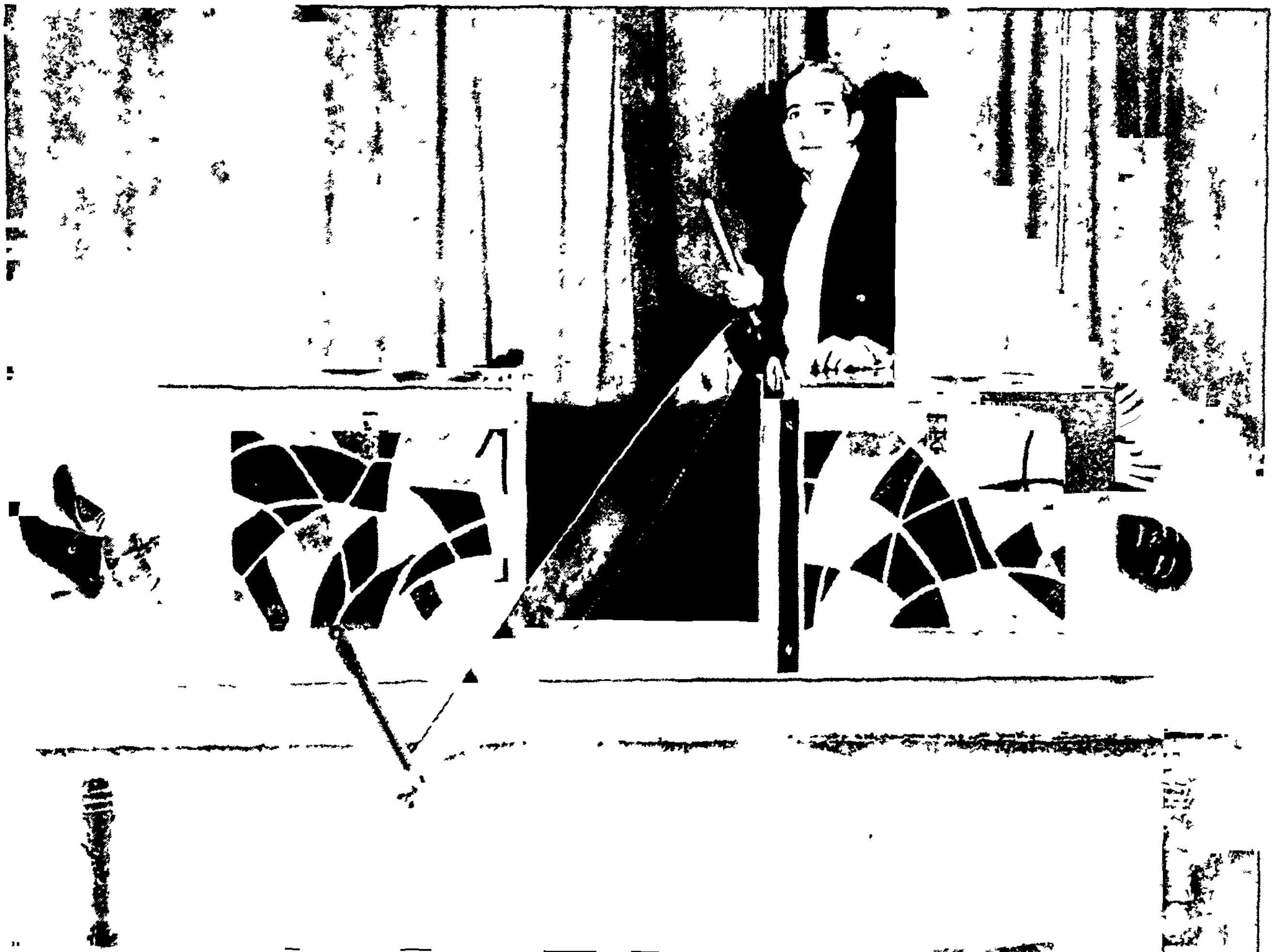
How Houdin stopped a rebellion is described in the text. The trick was reproduced in this scene from the film called, 'The March of the Years'. The noted magician, Elmer P. Ransom, plays the part of Houdin, and John Mulholland plays the rôle of the baffled Algerian priest.

Importance of Timing

Another element of the psychology of magic is timing. In this, magic is rather like baseball batting. The batter must not only swing his bat to the right spot, but he must swing it at the right instant. According to the manner in which an action is performed and the time at which it is done, a magician can impress an audience with what he is doing, or he can make them fail to notice that he did anything at all.

In the trick of making a coin disappear, you would surely be found out if you simply dropped the coin,

'WOMAN SAWED IN TWO'—THURSTON'S FAMOUS ILLUSION



In this spectacular trick, a woman stretched herself out inside the coffin-like box, the sides were closed, and Thurston sawed down through a joint in the middle. Then the halves of the box were pushed apart with the result shown here. Many explanations of the trick have been offered, including the obvious suggestion that two women were used. But Thurston never made public his method. Professional magicians are bound in honor not to reveal their secrets or those of their colleagues.

pretended to pick it up, and said, "It's gone!" After you have pretended to pick up the coin, you continue to act exactly as you did before—you go on apparently passing it from one hand to the other. Soon everyone has forgotten that you dropped the coin. The audience is positive it is still in your hands. Some, indeed, will be willing to swear later on that they actually saw it. It will be easy, then, for you to say, "I am going to make this coin disappear. Watch. It's gone!"

This is the simpler kind of deception—pretending to do a familiar action (handling the coin) without really doing anything. The other kind is doing a secret action in addition to what you seem to be doing. If you pretend to take a coin in your left hand, really retaining it in your right, and do it convincingly enough, everyone will believe that the coin is in your left hand. Later, when you open that hand, the coin, from the audience's viewpoint, will have mysteriously disappeared. But your finger skill will be useless if your timing is wrong.

Sleight of Hand and Showmanship

Most people have a wrong idea of sleight of hand, probably from the untrue slogan, "the quickness of the hand deceives the eye." Sleight of hand must be done slowly and gently, for quick, jerky motions attract attention, and the art of the magician lies in keeping attention away from his secret actions. The very slogan about the "quickness of the hand" is repeated by some magicians to mislead the spectators, so that they will watch alertly for some swift movement by the performer and fail to notice the normal motions with which the trick is actually done.

The great sleight-of-hand performers have always been natural and absolutely certain in their motions. Quickness has nothing to do with their art. It is more like fine surgery than juggling or even fast piano playing. Jugglers and pianists are trained to make quick motions, but they never try to deceive the eye. A skillful sleight-of-hand performer simply does a little more, or a little less, than he pretends to do.

Another important element in magic is to present the tricks so that the audience likes them. The magician's term for this is "showmanship." It is really the psychology of presentation. It means that the magician interests his audience in his work by his pleasing

HE LAUGHED AT LOCKS

Harry Houdini won world-wide fame for his ability to get out of prison cells and to escape from handcuffs.

manner, his friendly conversation, and by his knowing at all times just what to do next. A boring person who has learned some tricks is still boring, even if the tricks are puzzling; an entertaining person who knows tricks is a magician.

Equipment of the Magician

There is a vast amount of apparatus designed to help the magician perform his mysteries. It would take a much larger volume than this to list it all. Much of the apparatus is never seen by the audience at all and frequently the equipment which is shown to the audience has very little to do with the trick. There is hardly a familiar small object which has not been used for a trick, but coins, pieces of paper, cards, handkerchiefs, rope and string, eggs, and balls are most commonly used. It will be found that once a trick has been learned with an egg, for instance, it can also be done with a ball, or a rolled-up handkerchief. Feats in which people or large animals play a part usually can be done only on a stage and they require special mechanical equipment.

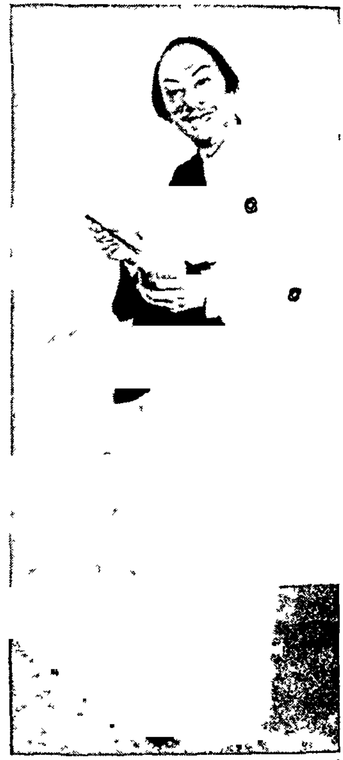
Professional magicians tend to specialize along certain lines. Alexander Herrmann did mostly small tricks. Harry Kellar, Howard Thurston, Horace Goldin, and Nicola became famous because of their large tricks—making a girl float in air, or sawing her in half, causing a horse to vanish, or making a lion in a big iron cage mysteriously appear. Houdini achieved his fame with tricks which permitted him to escape from any box, bag, or handcuffs into which he was put. T. Nelson Downs specialized in tricks requiring only coins, and Gus Fowler did his tricks only with watches and clocks.

MASTER AT SLEIGHT OF HAND

Cardini has just "found" that fan of cards in the air. Only years of practise could account for his smooth and graceful technique.

Magicians like to make their tricks seem like the things done in fairy tales. Because stage magic and fairy tales are so much alike, many people forget to distinguish one from the other. There is an old Chinese fairy tale about a boy who threw a rope up in the air in such a way that it stood on end. The rope then grew until its end was away up in the sky. The boy climbed up the rope and disappeared. The story is very much like Jack and the Beanstalk. Someone forgot that he had merely read about the boy and the rope, and told of having seen it all done by "a famous Hindu magician." All over the world, people who knew nothing about magic believed him and kept the old tale alive.

MAGICIAN PLUS ACTOR



John Mulholland perfected the blend of skill in magic with stagecraft. Here he is a "Japanese magician."

How to Learn Magic Tricks

The way for you to learn to do magic is, first, to read books describing tricks. When a trick particularly appeals to you, study it until you know just how to do it; practise that one trick over and over until you can do it very smoothly. Then pick out a second trick and learn to do it well.

Do not try to learn to do more than one trick at a time. As a beginner you will be wise to limit yourself to only five or six tricks until you have so perfected yourself in doing them that people are interested and entertained in watching you perform. When you have reached the point of being able to entertain with half a dozen feats of magic, you will find it easy to add more elaborate tricks to your program from time to time.

(For books about magic and magicians, see the section on Magic in the bibliography that accompanies the article Hobbies.)

MAGNA CARTA. The Great Charter of liberties of the English people is called Magna Carta (or Charta) in Latin, the language in which it was written. Barons and churchmen drew up the document and forced tyrannical King John to set his seal to it on June 15, 1215. Later kings repeatedly confirmed the Great Charter. The rights it proclaimed became part of English law and the foundation of the constitution of every English-speaking nation.

King John's cruelty and greed united against him all classes of his kingdom—the powerful feudal nobles, the churchmen, and the townsmen. While the king was waging a disastrous war in France, the leading barons of England met secretly together and swore to compel him to respect the rights of his subjects, as provided by previous law and custom. When John returned, they presented a series of demands. John tried to gather support, but almost all his followers deserted him. At last he met with the nobles and bishops "in a meadow which is called Runnymeade" on the Thames, and affixed his seal to Magna Carta (*see* John). Copies of the document were carried home by the principal barons, archbishops, and bishops. Three of these copies are still in existence. The best known is the copy at Lincoln Cathedral.

Historians now agree that the barons and bishops who forced Magna Carta on King John were acting in their own interests. Careful provision was made for limiting royal exactions, for providing more convenient courts, and for suppressing the misuse and extension of forest law. However, Magna Carta also provided certain guarantees for the people as a whole. Its 63 "chapters," or sections, necessarily deal with feudal rights and duties; but provisions were also included to protect merchants and townsmen. One of these reads: "All merchants may safely go away from England, come to England, stay in England . . . for buying and selling, without evil exactions—except in time of war if they are from a land at war with us."

MAGNE'SIUM. Two qualities make magnesium important. First, it is the lightest of the common metals; it weighs one third less than aluminum. Second, magnesium powder and shavings burn almost unquenchably. Hence magnesium is valuable in making alloys for airplane parts and in wartime for incendiary bombs and flares.

The metal is abundant in nature but is too active chemically to exist free. A common ore is *magnesite* (magnesium carbonate), a marble-like rock used in making firebrick. Another is *dolomite*, a calcium magnesium carbonate. Sea water contains the chloride and the sulfate.

Before the second World War, world production of magnesium was 30,000 tons a year. About 3,500 tons came from brine wells at Midland, Mich. War demands led to production of more than 100,000 tons a year in the United States, chiefly from sea water at Freeport, Tex., and ore deposits in California, Nevada, Washington, and Texas.

Manufacturers use magnesium alloys for lightness in making wheelbarrows, lawn mowers, canoes, tools, and home appliances. The mild alkali *milk of magnesia* is magnesia ($Mg(OH)_2$) suspended in water. Sir Humphry Davy identified magnesium in 1808, and Antoine Bussy isolated it in 1830.

MAGNET. To see "modern magic" at work, watch how steel scrap is moved in a modern mill. A traveling crane drops a huge metal disk upon the scrap. Instantly hundreds of pounds of metal cling to the disk. The crane moves the load wherever it is wanted, and lets the metal fall as though released by magic. Actually, the only "magic" is the use of magnetism.

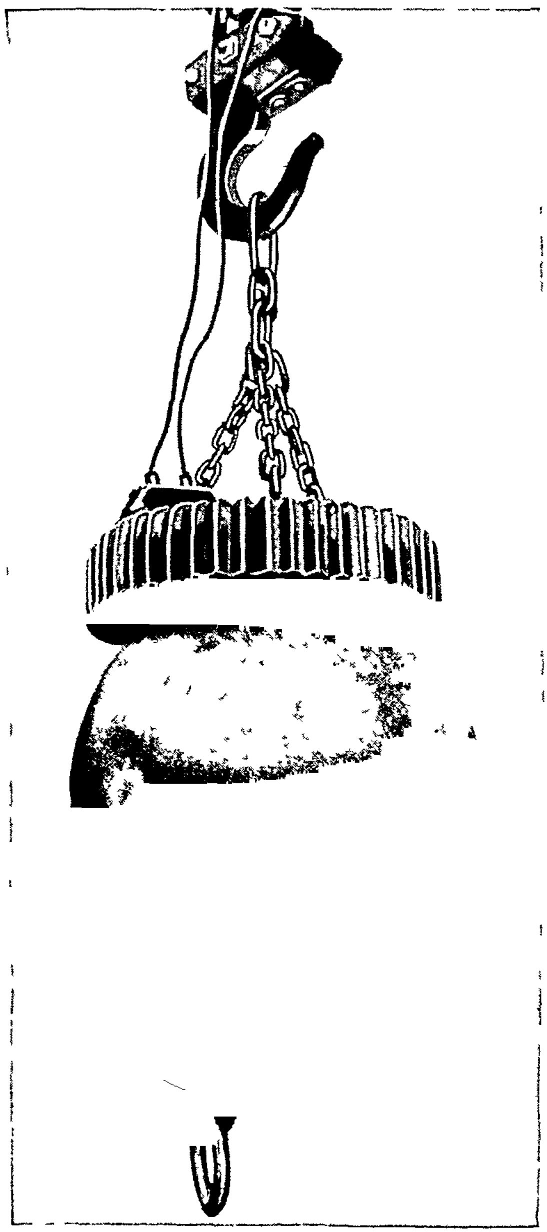
KING JOHN SETS HIS SEAL TO ENGLAND'S MAGNA CARTA

"Why do they not ask for my kingdom? I will never grant such liberties as will make me a slave!" This was the answer King John made to the first demand of his barons for a charter of reforms. Eventually, however, he was forced to yield.

This machine is simply a powerful electromagnet, big brother to the tiny toy "horseshoe" magnets.

What is magnetism? For centuries men have known that a certain iron ore, popularly called "lodestone," has the remarkable property of attracting other bits of iron. Because it was found in large quantities near the ancient city of Magnesia in Syria, the early Greeks and Romans called lodestone *magnes*, from which "magnetism" is derived. Those early investigators discovered that the magnetism of lodestone is "catching." Iron rubbed over lodestone becomes itself magnetic.

THE "SKULL CRACKER" AT WORK



A powerful lifting magnet is here shown raising a huge piece of metal weighing 12,000 pounds, known in the slang of the shop as a "skull cracker." The "skull cracker" is used to break up metal castings. When the current is turned off, it falls on them with shattering force.

North and South Poles

If you test a magnetized knitting needle, you will find that *either end will attract* unmagnetized iron equally well. The ends seem to be alike; but they are not, as you will quickly see if you suspend the needle from a fine thread tied to its middle. The needle will swing around until one end points toward the north and the other toward the south. This is why every magnet is said to have two poles—a "north-seeking pole" and a "south-seeking pole," usually called simply the *north pole* and the *south pole*. This principle gives us the magnetic compass (*see* Compass, Magnetic). If you bring another magnetized knitting needle near the first one, you will observe another fundamental principle of magnetism. While the north-seeking end of one needle will be strongly attracted by the south-seeking end of the other, the two "norths" and the two "souths" will vigorously *repel* each other. The rule is that unlike poles attract; like poles repel.

William Gilbert (1540–1603), leading scientist in England during the reign of Queen Elizabeth I, first realized that the earth itself is a giant magnet. However, its magnetic poles are several hundred miles away from its geographic poles. Furthermore, what is called the north magnetic pole of the earth is really its south-seeking pole, since it attracts the north-seeking pole of ordinary magnets.

The space around a magnet in which its influence is exerted is called its "field." Through this field appear to run "lines of force" with a definite direction or "flux," as illustrated by the pictures on the next page. If we place a piece of *iron in this field*, the lines of force will tend to crowd into it, because they travel through iron easier than through air. In technical terms we say the "magnetic permeability" of iron is higher. This helps explain how the "catching" quality of magnetism extends more or less throughout the magnetic field, so that magnet*ism can be transferred* or "induced" without actual contact. An interesting proof of this and other important magnetic facts can be given with the aid of a bar of soft iron and a compass. First, test the bar with the compass to make sure that it is not already magnetized. Next, point one end of the bar toward the north pole (as indicated by the compass) and strike the other end a few sharp blows with a hammer. Now test the bar again, and you will find it has become magnetized.

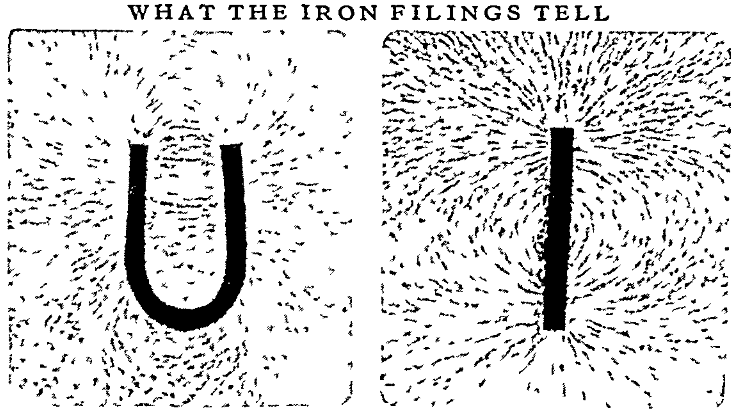
A Theory of Magnets

What has happened? The magnetic lines of force in the earth's field have induced magnetism in the iron. According to the theory of magnetism, each of the millions of molecules of iron that make up the bar is a tiny natural magnet; but these are ordinarily arranged in a helter-skelter fashion, so that they neutralize one another. When the hammer jars them, a great many of them swing around in line with the earth's magnetic field. As proof of this, turn the bar east-and-west and hammer it again. You will find its magnetism has vanished. The molecules have been disarranged and no longer work in harmony.

This theory that all magnets are made up of tiny lined-up molecular magnets rests on many other

facts Heat a permanent magnet red hot, which disturbs its molecular structure, and its magnetism disappears. Break a magnet in two, and a new north pole and a new south pole will be formed at the break. Hard steel, in which the molecules are densely packed together, is much harder to magnetize than soft iron, but keeps its magnetism better once it is acquired.

WHAT THE IRON FILINGS TELL



Two magnets—a horseshoe magnet and a bar magnet—are shown here, each covered with a sheet of glass upon which iron filings have been sprinkled. The filings have arranged themselves in symmetrical patterns, which show us how the lines of magnetic force are exerted in the surrounding space and from pole to pole.

Some other metals, chiefly nickel and cobalt, have magnetic properties similar to those of iron, though much feebler. Mixing these with iron, however, often yields alloys of great magnetic value (*see* Alloys).

Permanent magnets play an important part in our lives. They are used in telephone receivers, speedometers, electrical measuring instruments, magnetos, and countless other devices. Usually they are bent in horseshoe form, which, by bringing the poles close together, concentrates the strength of their field.

Electricity and Magnets

The connection between electricity and magnetism, described in detail in the article on Electricity, is one of the most important principles of science and industry. It is the basis of the electric generator and motor, giving us power, light, and transportation; of the telegraph and telephone; and of many of the essentials of radio. Here we need only examine a simple electromagnet.

Take a short iron rod, like a common bolt, and wind around it about 50 turns of insulated wire. Connect the ends of the wire to an ordinary dry cell. At once the bolt becomes a strong magnet. Disconnect the wire and most of the magnetism disappears. Here we have the essential value of the electromagnet—that its action can be controlled at will. In all other essentials it obeys the same rules as a permanent magnet. A simple way to determine its polarity is to grasp it with the right hand so that the fingers are pointing in the direction in which the current is flowing (positive to negative) around the turns of wire, then the thumb will point to the north pole of the magnet. The strength of an electromagnet depends upon the number of turns of wire and the amount of current flowing through them.

MAGNOLIA IN FULL DRESS

Distinguished by leaves much larger and longer than those of other magnolias, the umbrella tree grows from Pennsylvania south to Alabama and Mississippi. The flowers of this species have an unpleasant odor. The fruit cone is rose-colored.

MAGNOLIA. The creamy-white blossoms of the great-flowered magnolia make this tree a veritable queen of our parks and gardens. The glossy evergreen leaves form a fit setting for the flowers, which are often eight to twelve inches in diameter. The flowers emerge from their furry brown buds in May and June and are succeeded by conelike fruits which are reddish when ripe. In its natural state this tree attains a height of 70 to 100 feet, having a straight trunk and spreading limbs It is native to the southeast, from South Carolina to Louisiana. The perfume is heavily fragrant.

The sweetbay is very much more widely distributed than the great-flowered species, but neither in size nor beauty can it compare with its magnificent cousin. It is native from Massachusetts to Florida and westward to Louisiana, varying from a mere shrub to a height of 50 to 60 feet. The cucumber tree, which bears greenish-yellow blossoms, is another American type. It is so named from the fruit, which when green resembles a cucumber.

Found in Many Lands

Altogether there are about 35 species of magnolia, native to the Himalayas, India, and other regions in Asia as well as to many parts of Central and North America. Some are evergreen and others deciduous, while the blossoms range from white and light yellow to deep rose and purple.

By selection and cross-breeding additional beautiful varieties have been produced, which flourish in hothouse, garden, and park. The range of some species has been extended and beautiful specimens may now be found flourishing in regions far separated

from their native haunts; for instance, the great-flowered magnolia is found as far north as Pennsylvania, and Chinese species grace gardens in both England and America. The genus is named for Pierre Magnol, a French botanist of the 17th century.

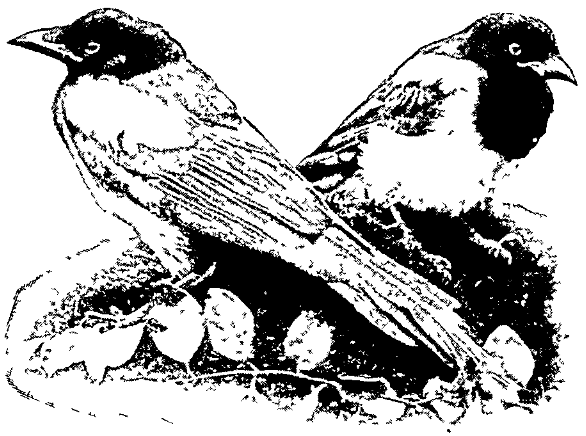
Scientific name of the great-flowered magnolia, *Magnolia grandiflora*. Bark brownish-gray, with scales of about one inch in length, lying close together. Leaves simple, alternate, evergreen, entire, ovate. Flowers cream-white, with heavy lemon fragrance; 6, 9, or 12 petals. Fruit a reddish conelike pod, about the size of a hen's egg.

MAGPIES, JACKDAWS, AND ROOKS. These noisy birds are a robber-band that, with the jays and ravens, belong to the crow family (*Corvidae*). Magpies are handsome birds, from 16 to 20 inches long, with glossy black and snow-white plumage, and long pointed tails. They are found in the Old World and in western North America. If encouraged they make friends with human neighbors and are easily tamed. The magpies build their nests with consummate art, leaving a hole in the side for admittance, then covering the whole upper part with an interweaving of thorny sticks. This serves as a retreat protecting them from the attacks of other birds. The magpie is a crafty rascal, accused of every crime. To other birds he is ever a foe, and sometimes he becomes too familiar with human property. His call is a rasping *cack*, *cack*, and a garrulous gabble intermixed with whistling notes. Hence he is a "chattering magpie."

The jackdaw and rook are both Old World birds. The rook, a bit smaller than the crow, has a decided purplish tinge over his plumage. The adult birds shed the face feathers, leaving the skin about the bill bare. They feed entirely on insects and grain. Rooks nest in large communities or rookeries. The winter habits vary; some migrate south and some remain in the same district throughout the year. The jackdaw wears a black coat with a gray collar. Its food habits are like those of the rook, with which it often lives in company. Jackdaws find almost any nook or cranny a suitable nesting site; rock cavities or chimneys are equally acceptable.

Scientific name of American magpie, *Pica pica hudsonia;* of rook, *Corvus frugilegus;* of jackdaw, *Corvus monedula*. The yellow-billed magpie, *Pica nuttalli*, inhabits California.

THE AMERICAN MAGPIE'S MOTLEY COAT

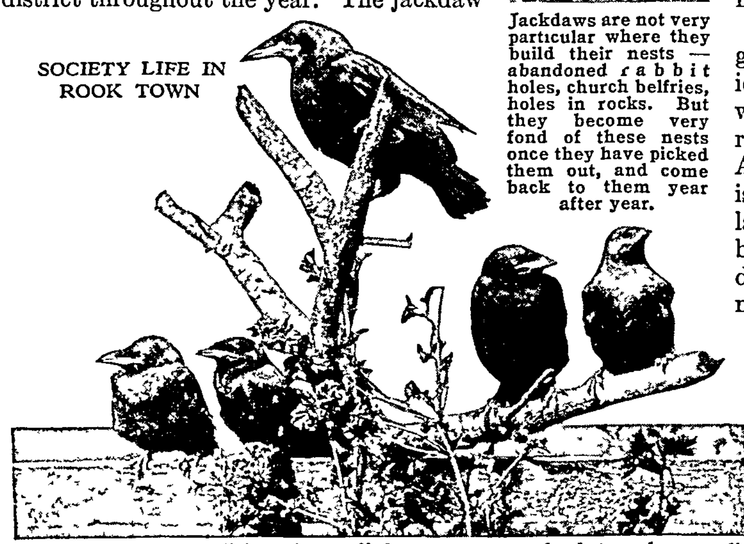


A striking suit of black and white and a long tail, black with greenish iridescence, make the American magpie conspicuous. He finds much of his food on the ground, and hops about with great agility picking up grubs, snails, and grasshoppers.

AT HOME!

Jackdaws are not very particular where they build their nests — abandoned rabbit holes, church belfries, holes in rocks. But they become very fond of these nests once they have picked them out, and come back to them year after year.

SOCIETY LIFE IN ROOK TOWN



These are rooks—English rooks—a little group on a dead tree by a wall. In their nests among the old elms of the English estates you will find them by hundreds and by thousands, particularly in the evening when they come to roost.

MAHOGANY. Prized for its beauty, durability, and ease in working, mahogany has long been used for building ships and for making fine furniture. The Spanish colonists found the wood when they came to the New World and were soon using it to repair their sailing vessels. No one knows when mahogany was introduced into Europe, but by the 18th century it was considered by English cabinetmakers to be the most elegant of all woods.

The mahogany tree is an evergreen and grows in the West Indies and tropical America. It often attains a height of 100 feet, with a trunk 12 feet in diameter and a reach of 60 feet or more to the first limb. Although the supply is abundant, the wood is expensive because of the tremendous labor involved in getting it. There may be only one or two trees to the acre of dense forest, and paths connecting with the main trails must be cleared to each tree before felling can begin. In most places, after the tree is cut, it must be dragged by oxen or tractors to a river bed to wait for the floods to carry it to the seaboard. In only a few locations can the logs be transported by barge and train.

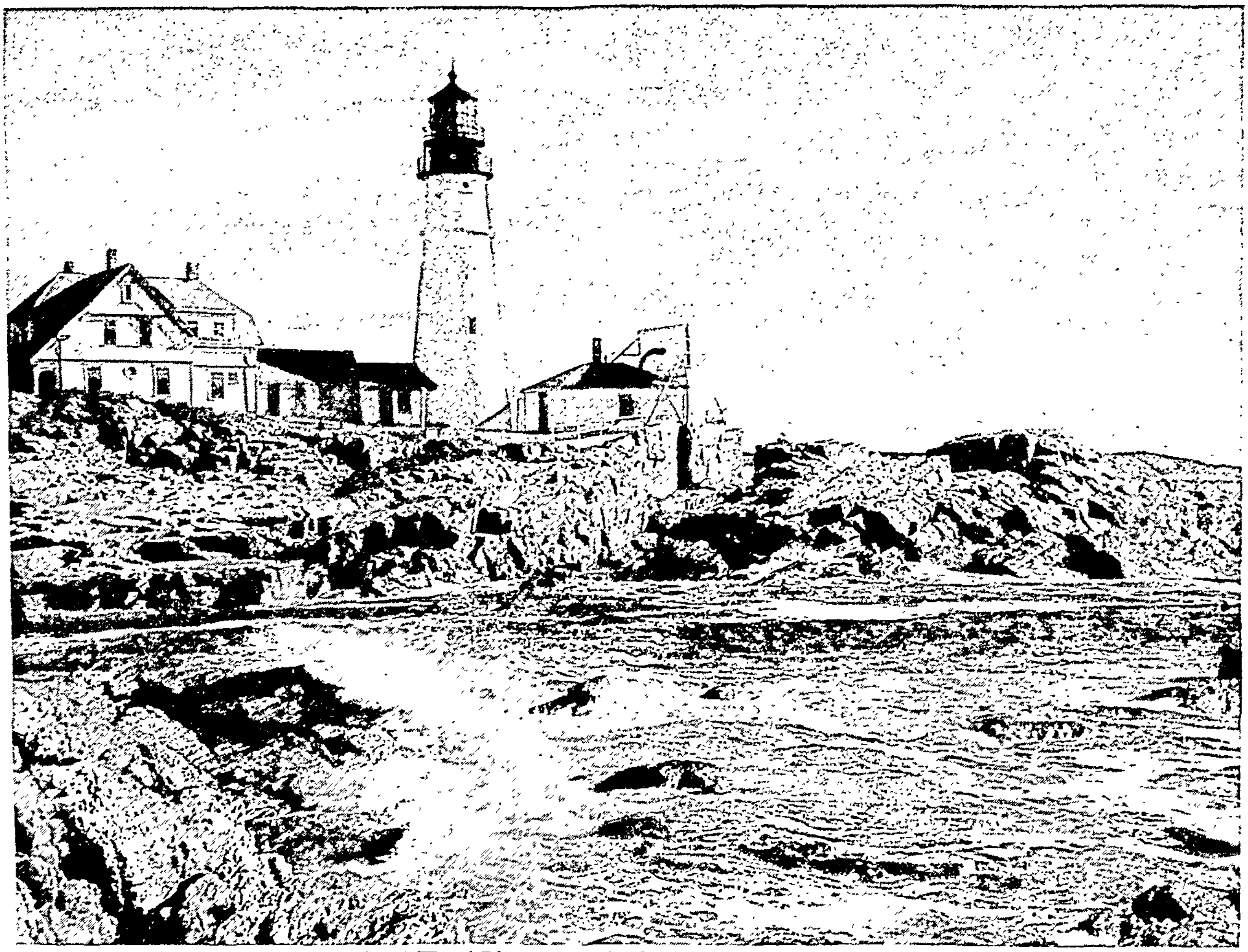
In color, mahogany ranges from light reddish tan to deep golden brown. In grain it varies from the plain stripe of the main trunk to the swirling, figured

patterns near roots and limbs. It takes a high polish and need not be heavily stained, for it grows darker with age. Since it does not warp or shrink easily and glues well, it is much used for veneers. Because it can be formed easily and withstands dampness well, it is widely used for building small boats.

Genuine mahogany is marketed, according to its source, as West Indian mahogany or Tropical American mahogany. West Indian mahogany is preferred for the finest furniture. Closely related to the true mahogany is African mahogany (Khaya wood). It is much used in veneers because of its lavish pattern. Several hardwoods from the Philippines are marketed under the trade name "Philippine mahogany." They are not true mahogany. Birch and gumwood are often stained and patterned to imitate mahogany.

True mahogany belongs to the genus *Swietenia*, of the family *Meliaceae*. Principal species, *Swietenia mahogani* (Florida and West Indies) and *Swietenia macrophylla* (Mexico, Central and South America). Chief source of "African mahogany," *Khaya ivorensis;* of "Philippine mahogany," the lauan trees *Shorea negrosensis* and *Pentacme contorta*, and the tangile tree *Shorea polysperma.*

The EASTERNMOST STATE *of the* UNION



Portland Head Light—Sentinel of Maine's Rocky Shores

MAINE. Tucked away in the northeastern corner of the United States is Maine, the only state in the Union that borders only one other state. Maine's sole neighboring state is New Hampshire, on the southwest. To the northwest, north, and east lies Canada. On the south is the Atlantic. The easternmost point in the United States is West Quoddy Head in Maine.

Maine is noted for its thrifty, independent people and picturesque coasts, hills, forests, and streams. Its rugged coast is fringed with hundreds of bays. Some, sheltered by small islands, make fine harbors. Here in the summer months, boating and bathing are favorite sports. Most of the state, however, consists of rolling hills and valleys, with a rocky plateau running northeasterly across the middle of the state. It descends from a general elevation of about 2,000 feet to about 600 feet in the extreme northeast. It is marked by isolated ridges and peaks. Mount Katahdin (5,268 feet) near the center of the state is one of the high points in the eastern United States. It lacks only a few feet of towering exactly one mile above sea level.

Covering a large part of the wilder rocky area are great forests, splashed with countless lakes and cut by numberless rivers and streams. The woodland shelters much of the same kind of wild life as existed in the

days of the pioneer settlers. The solitudes are inhabited by deer and bear, the streams are full of game fish, and the lakes abound with waterfowl.

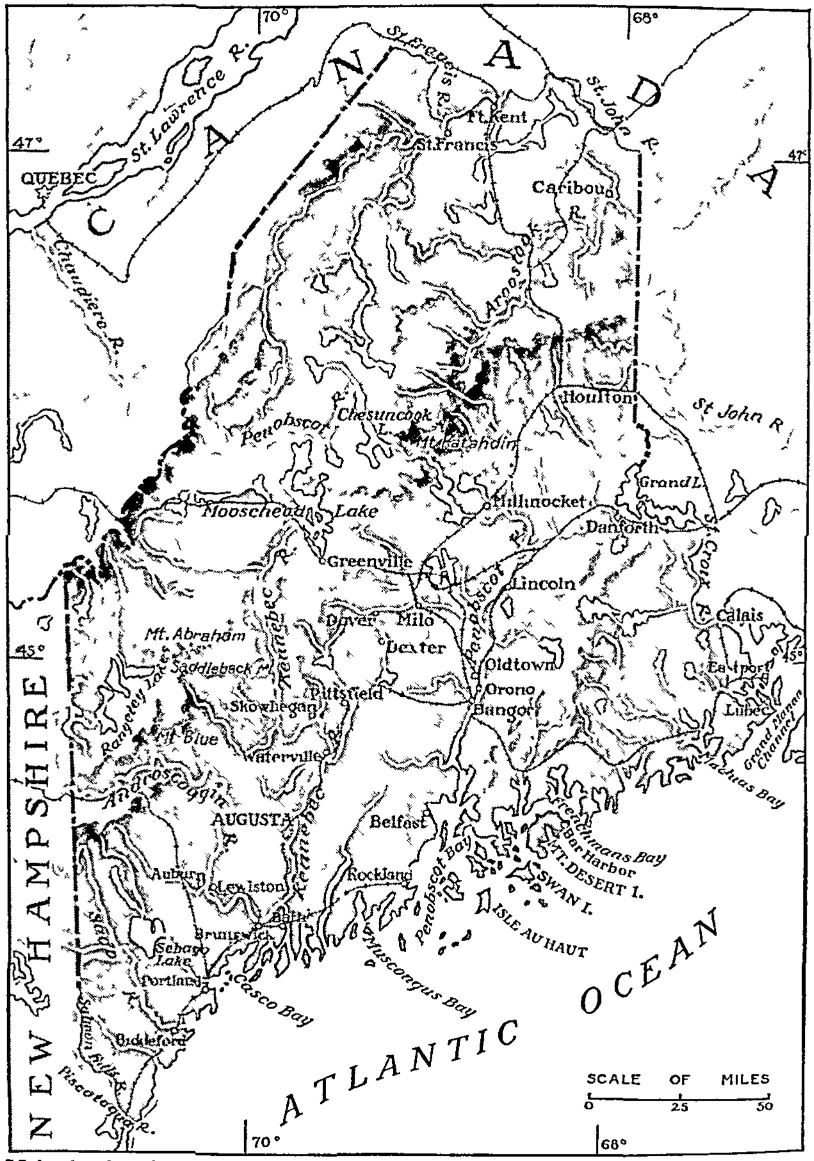
For more than half a century people from all parts of the United States have been coming to Maine for fishing and hunting. Railroads reach every county, but old Indian trails and canoe routes are still much traveled, just as they were by the first explorers. Even Indians are not lacking, for members of the once powerful Penobscot tribe remain to act as guides.

Visitors can drive to many modern hotels; but often they need go only a few rods from the road to be *in the wildwood*. *The Maine Turnpike* extends 44 miles through scenic beauty from the Maine-New Hampshire Interstate Bridge near Kittery to Portland. In 1954 a 58-mile extension of the turnpike to Augusta was under construction.

Old and New Forest Products

Pleasure is not all that the wilderness yields. An immense amount of timber is cut from it every year to be floated down the rivers to the cities and there converted into lumber and wood pulp. About 84 per cent of the land area of the state is forested. Its giant white pines gave Maine the name "Pine Tree State." Its great stands of spruce make it one of the leading states in the production of pulp and paper.

ROCKBOUND COAST OF THE "PINE TREE STATE"



Maine has long been settled along its rocky coasts and on its lowlands. The rugged highlands, however, have extensive regions which have been little touched by civilization.

The shift from lumber and timber to pulp and paper made ghost towns of once thriving communities and gave birth to new cities. Bangor on the Penobscot River, once a great lumber market, is now primarily a commercial and tourist center for the lake region to the north. On the other hand, such towns as Winslow, Millinocket, Rumford, and Woodland owe much of their growth to the pulp industry. All have the advantage of proximity to the forests and water power to operate their mills. Augusta, the capital, on the Kennebec River, has paper and pulp mills, textile mills, and shoe factories (*see* Augusta).

Potatoes and Sweet Corn Are Farm Specialties

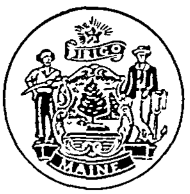
Although the soil is ungenerous for the most part, farming has shown phenomenal development in the most northern county—Aroostook. This section is famous throughout the world as a potato-growing region. Modern methods in cultivation, combined with the unusual adaptability of the soil, not only make the average yield per acre exceptionally large but produce stock unexcelled for either food or seed. Hay, grain, and other crops also grow well in this section. South of the forest region milk, vegetables, and fine winter apples are produced, and immense quantities of apples, squashes, blueberries, and sweet corn are canned and shipped. Maine-packed sugar corn is a favorite in all the markets.

Manufactures, Fish, and Minerals

Waterfalls and swiftly flowing rivers make Maine rich in natural water power and have attracted many factories. Chief among them are those producing paper, wood pulp, and other timber products, cotton and woolen goods, boots and shoes, while canning and preserving are also important industries. Up to 1890 Bath was the chief shipbuilding center of the United States, and nearly half of the ocean vessels

Continued on page 55

Maine Fact Summary



MAINE (Me.): In early times referred to as the "Main" to distinguish it as mainland rather than one of the many coastal islands.

Nickname: Usually "Pine Tree State," because of its pine forests and because the pine tree is one of the symbols on the state seal.

Seal: Shield shows moose lying at foot of pine tree. On left of shield, farmer rests on scythe; on right, sailor rests on anchor; north star shines above.

Motto: Dirigo (I direct, or guide).

Flag: For description and illustration, *see* Flags.

Flower: White pine cone and tassel. **Bird:** Chickadee. **Tree:** White pine. **Song:** 'State of Maine Song'—words and music by Roger Vinton Snow.

THE GOVERNMENT

Capital: Augusta (since 1832).

Representation in Congress: Senate, 2; House of Representatives, 3. Electoral votes, 5.

State Legislature: Senators, 33; term, 2 years. Representatives, 151; term, 2 years. Convenes 1st Wed. in Jan. in odd years. No limit to session length.

Constitution: Adopted 1820. Proposed amendment must be (a) passed by a two-thirds vote of the legislature and (b) ratified by a majority voting on amendment at a popular election.

Governor: Term, 2 years. May succeed himself.

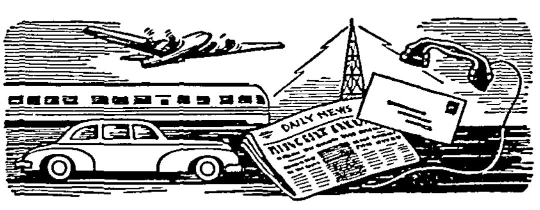
Other Executive Officers: Secretary of state, attorney general, treasurer; terms, 2 yrs. Auditor, commissioner of agriculture; terms, 4 yrs. Executive council of 7 members; all chosen by the legislature.

Judiciary: Supreme judicial court—6 justices; term, 7 yrs.; superior court—7 justices; term, 7 yrs.; all these justices appointed by governor subject to approval of executive council. Probate courts—1 in each county; judge elected; term, 4 yrs.

County: 16 counties, each governed by a board of commissioners of 3 members; term, 6 years. Commissioners and other officers elected.

Municipal: Most cities have a city manager and council. Towns are governed by a board of selectmen and other officials, elected by popular vote at annual town meetings.

Voting Qualifications: Age, 21; residence in state, 6 months; in local unit, 3 months. Literacy test.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 1,900 miles; first railroad, Bangor to Old Town, 1836. Rural roads, 20,700 miles. Airports, 64.

Communication: Periodicals, 21. Newspapers, 58. First newspaper, *Falmouth Gazette*, 1785 (Portland). Radio stations (AM and FM), 17; first station, WCSH, Portland, licensed July 24, 1925. Television stations, 1, WABI-TV, Bangor, began operation Jan. 31, 1953. Telephones, 245,500. Post offices, 667.

THE PEOPLE AND THEIR LAND

Population (1950 census): 913,774 (rank among 48 states—35th); urban, 51.7%; rural, 48.3%. Density: 29.4 persons per square mile (rank—34th state).

Extent: Area, 33,215 square miles, including 2,175 square miles of water surface (38th state in size).

Elevation: Highest, Mount Katahdin, 5,268 feet, northwest of Millinocket; lowest, sea level.

Temperature (°F.): Average—annual, 43°; winter, 19°; spring, 41°; summer 65°; fall, 47°. Lowest recorded, −48° (Van Buren, Jan. 19, 1925); highest, 105° (North Bridgton, July 10, 1911, and other locations and dates).

Precipitation: Average (inches)—annual, 40; winter, 9; spring, 10; summer, 10; fall, 11. Varies from about 48 on central coast to about 31 in northeast.

Natural Features: A broad plateau, with scattered mountain peaks, extends from the western boundary to the northeast across the Rangeley and Moosehead Lake districts; it gradually slopes eastward toward the Penobscot River basin and northeast to the St. John River. Ragged tidal shore line totals 3,478 miles. Principal rivers: Androscoggin, Kennebec, Penobscot.

Land Use: Cropland, 6%; nonforested pasture, 2%; forest, 84%; other (roads, parks, game refuges, wasteland, cities, etc.), 8%.

Natural Resources: *Agricultural*—84% of state is forested; soil suitable for intensive farming found in north and south. *Industrial*—forests, fish, water power, cement, stone, sand and gravel, slate, feldspar, peat, clays, mica, lime, columbium, beryllium, lithium minerals, quartz, and gem stones. *Commercial*—protected harbors; hilly lake region outstanding for resort trade.

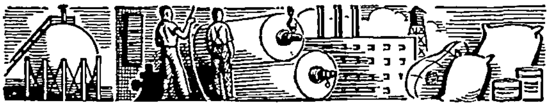
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Manufacturing	106,929	34.3
Wholesale and retail trade	52,626	16.8
Agriculture, forestry, and fishery	34,709	11.1
Professional services (medical, legal, educational, etc.)	25,400	8.1
Transportation, communication, and other public utilities	22,625	7.2
Personal services (hotel, domestic, laundering, etc.)	18,575	5.9
Construction	16,771	5.4
Government	12,097	3.9
Business and repair services	8,170	2.6
Finance, insurance, and real estate	6,727	2.2
Amusement, recreation, and related services	2,121	0.7
Mining	617	0.2
Workers not accounted for	4,959	1.6
Total employed	312,326	100.0

Maine Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—31st)
Value added by manufacture* (1952), $525,514,000

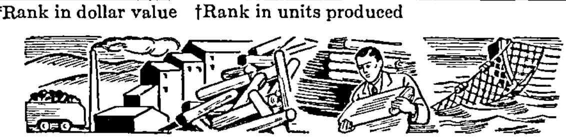
Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
TEXTILE MILL PRODUCTS .... Cotton broad-woven fabrics; woolen and worsted fabrics	$116,512,000	13
PAPER AND ALLIED PRODUCTS...... Pulp, paper and paperboard mills	103,156,000	10
LEATHER AND LEATHER PRODUCTS. Footwear, except rubber	47,979,000	10
FOOD AND KINDRED PRODUCTS..... Canned sea food; bakery products; canned fruits, vegetables, and soups; meat packing	42,409,000	33
LUMBER AND PRODUCTS...........	36,973.000	22
MACHINERY (EXCEPT ELECTRICAL). Textile machinery	26,728,000	24

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—37th)
Total cash income (1952), $213,543,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Potatoes.......	59,654,000 bu.	1	1
Milk..........	292,000,000 qts.	2	39
Hay..........	856,000 tons	3	33
Eggs..........	31,000,000 doz.	4	35
Chickens......	34,300,000 lbs.	5	35
Cattle.........	35,715,000 lbs.	6	42
Oats..........	3,281,000 bu.	7	32
Hogs..........	16,797,000 lbs.	8	41

*Rank in dollar value †Rank in units produced



C. Fish (Rank among states—8th)
(Marine waters and coastal rivers, 1950), catch, 356,266,000 lbs.; value, $14,689,000

D. Lumber (Rank among states—22d)
387,000,000 board feet (5-year average)

E. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $8,516,000
Rank among states—44th

Minerals (1951)	Amount Produced	Value
Cement*................	....	....
Stone..................	645,000 tons	$2,582,000
Sand and gravel.	5,367,000 tons	1,817,000

*Cement ranks 1st in value; exact figures not available.

F. Trade

Trade (1948)	Sales	Rank among States
Wholesale.........	$490,529,000	40
Retail............	755,651,000	35
Service...........	60,199,000	38

EDUCATION

Public Schools: Elementary, 1,311; secondary, 191. Compulsory school age, 7 through 14, (17 in special cases). State Board of Education consists of 10 members appointed for 5-yr. terms by governor. With consent of Executive Council, it appoints state commissioner of education. Town and city school committees elected; appoint city and town supts. Joint school committees of towns in a union appoint school supts. for 5-yr. maximum terms.

Private and Parochial Schools: 141.

Colleges and Universities: Colleges, 8; junior colleges, 2. State-supported schools include Univ. of Maine, Orono; Vocational-Technical School, Augusta; teacher training schools—Farmington State Teachers Col.; Gorham State Teachers Col.; Aroostook State Teachers Col., Presque Isle; Madawaska Training School, Fort Kent; Washington State Teachers Col., Machias.

Special State Schools: Maine School for the Deaf, Portland; Pownal State School (for the mentally retarded); Military and Naval Children's Home, Bath; Maine Vocational-Technical Inst., South Portland.

Libraries: City and town public libraries, 192. State Library responsible for aid in developing library service. Noted special library: Maine Historical Soc., Portland.

Outstanding Museums: Bowdoin College Museum of Fine Arts, Brunswick; Wilson Museum, Castine; Brick Store Museum, Kennebunk; L. D. M. Sweat Memorial Art Museum, Portland; William A. Farnsworth Library and Art Museum, Rockland; Penobscot Marine Museum, Searsport.

CORRECTIONAL AND PENAL INSTITUTIONS

State School for Boys, South Portland; State School for Girls, Hallowell; State Reformatory for Men, South Windham; State Reformatory for Women, Skowhegan; Maine State Prison, Thomaston.

NATIONAL PARK*

Acadia—29,978 acres; on Mount Desert I. and Schoodic Peninsula; mountains and lakes; Mount Cadillac (1,532 ft.) highest peak on eastern coast; Somes Sound, 5-mi. fiord; first national park in East (12).

STATE PARKS*†

Aroostook—Quoggy Joe Mountains rise 600 feet above Echo L.; views of Canada and Mount Katahdin (1).

Baxter—trails along lakes and streams; Mount Katahdin, state's highest point (5,268 ft.); Baxter Peak, one end of Appalachian Trail (Maine to Georgia) (2).

Bradbury Mountain—near Pownal Center; panorama of Casco Bay; views of White Mts. and Mt. Blue; 18th-century stone cattle pound; feldspar quarries (18).

Fort Knox—built in 1846 during boundary disputes of colonists and Great Britain; fine stone work (8).

Lake St. George—in two parts; lake beach in Liberty; 1,050-foot Frye and Spear Mts. in Montville (7).

Lamoine—on Frenchman's Bay; ocean beach; view of Mount Desert Island and Mt. Cadillac; s.e. of (8).

Mount Blue—mountain scenery; rolling hills; 3,187-foot Mount Blue; beach on Lake Webb (5).

Salmon Falls—in Hollis on east branch of Saco River; wooded ravine; south of (16).

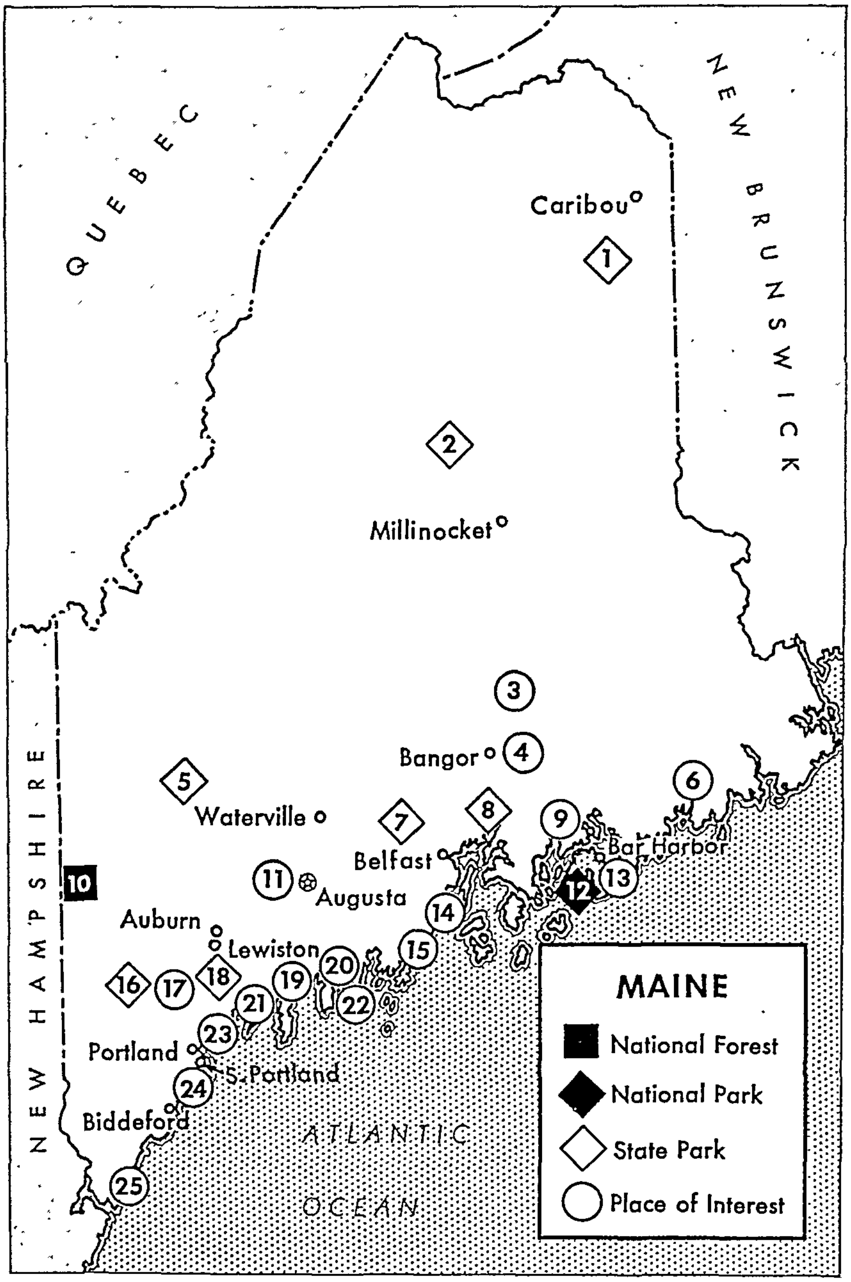
Sebago Lake—beaches along Songo R.; Indian relics (16).

*Numbers in parentheses are keyed to map.
†Camden Hills, north of Camden, and Reid, southeast of Georgetown, are new state parks. *See* Places of Interest on next page.

Maine Fact Summary

PLACES OF INTEREST*

Augusta — *see* Blaine House, Fort Western, State House entries on this page *and also* Augusta (11).
Bath—old shipbuilding works; Davenport Memorial Museum contains exhibits of Maine maritime history (19).
Black Mansion—built in Ellsworth in 1820 by Colonel John Black, land agent; many original furnishings (9).
Blaine House—built in Augusta about 1830; James G. Blaine's home from 1862 to his death; rare furniture; now governor's residence (11).
Bok Memorial Amphitheater—in beautiful park and garden on the water front in Camden (14).
Camden Hills (recent addition to state park system)—n. of Camden; meeting point of high hills; impressive view of Penobscot Bay (14).
Fort Western—Augusta; fort erected in 1754 on site of Plymouth trading post; garrison house restored (11).
Fort William Henry—Pemaquid Beach; replica of old fort built 1692 (22).
Harriet Beecher Stowe House—Brunswick; where 'Uncle Tom's Cabin' was written (21).
Hawthorne House—So. Casco; Nathaniel Hawthorne's childhood home (17).
Montpelier—Thomaston; replica of home of Henry Knox, secretary of war under Washington; fine example of colonial architecture (15).
Mount Desert Island—famous for scenery and summer resorts including Bar Harbor (13).
Old Town Indian Reservation—home of remaining members of Penobscot tribe, the last of the Abnaki Nation; on Indian Island off Old Town (3).
Old York Gaol—jail built in 1653 at York; one of oldest public buildings in New England; now museum (25).
Peirce Memorial—statue of river drivers breaking log jam; lumbering was early industry of Bangor area (4).



Portland—*see* Portland City Hall, Tate House, Wadsworth-Longfellow House on this page (23).
Portland City Hall—auditorium has Kotzchmar Memorial Organ, one of largest organs in world (23).
Portland Head Light—guards Portland Harbor; oldest lighthouse on Maine coast (1791) (24).
Reid (recent addition to state park system)—southeast of Georgetown; seashore park with beaches; near (22).
Ruggles House—Columbia Falls; excellent example of colonial architecture; hand-carved woodwork (6).
Saint Croix Island National Monument Project—island in Saint Croix R.; settled by French, 1604; n. e. of (6).
State House—designed by Charles Bulfinch; completed in 1832, rebuilt in 1911; State Library here (11).
Tate House—built in 1755; restored home of George Tate, mast agent for British navy; beautiful paneling (23).
Wadsworth-Longfellow House—exhibits of personal belongings of the poet and of early Portland history; Maine Historical Society Museum located here (23).
Wiscasset—houses built by shipping merchants and sea captains; now colony for artists and writers (20).

NATIONAL FOREST*

White Mountain—53,551 acres in Maine; 798,291 acres in New Hampshire; headquarters, Laconia, N. H. (10).

LARGEST CITIES (1950 census)

Portland (77,634): seaport; railroad center; food and fish processing; paper, furniture, textile products, tools.
Lewiston (40,974): textile city on Androscoggin River; joined industrially to Auburn, on other side.
Bangor (31,558): river port; resort center; shoes, paper.
Auburn (23,134): shoe manufacturing; Auburn and Lewiston, across Androscoggin River, called "Twin Cities."
South Portland (21,866): residential suburb; shipyards.
Augusta (20,913): state capital; lumber and textile mills.
Biddeford (20,836): joined industrially with Saco, on opposite side of Saco River; textiles, textile machinery.
Waterville (18,287): railroad center; paper and textiles.

*Numbers in parentheses are keyed to map.

Maine Fact Summary

THE PEOPLE BUILD THEIR STATE

1497—John and Sebastian Cabot sail along coast of Maine; establish England's claim to New World.

1524—Giovanni da Verrazano, an Italian exploring for France, reaches coast of Maine.

1569—David Ingram, English sailor marooned on coast of Gulf of Mexico, follows Atlantic coast north to Penobscot River; his accounts spur English explorations.

1603—King of France grants Pierre de Guast, Sieur de Monts, area (named Acadia) from Nova Scotia to Hudson River; de Guast and Samuel de Champlain arrive, 1604; Champlain explores region; colony moved to Nova Scotia, 1605.

1605—Capt. George Weymouth visits Monhegan and explores coast; kidnaps five Indians, taking them to England.

1606—Plymouth Company granted charter to plant colony in "northern Virginia" (38° to 45° N.).

1607—Popham Colony (St. George) established near present Popham Beach; launch *Virginia*, first ship built by Englishmen in North America, 1608; colony abandoned same year.

1609—Henry Hudson in *Half Moon* stops in Casco Bay.

1611—Father Pierre Biard founds mission near site of Old Town.

1613—French Jesuit colony established on Mount Desert Island but is soon dispersed by the English.

1614—Capt. John Smith establishes first fisheries at Monhegan; charts Maine coast line.

1620—Plymouth Company granted "Great Patent" to New England (40° to 48° N.); becomes Council for New England.

1622—Council for New England grants to Sir Ferdinando Gorges and Capt. John Mason the land between the Merrimack and Kennebec rivers, called "province of Maine." Permanent settlements begun at Monhegan; at Saco, 1623; at York (then Agamenticos and later Gorgeana), 1624.

1629—Mason and Gorges divide their land; Mason gets area west of Piscataqua River (province of New Hampshire); Gorges calls his area east of the Piscataqua New Somersetshire.

1630—Plymouth Council (England) grants large tract in Maine to John Beauchamp and Thomas Leverett; grant called "Muscongus Patent."

1635—Council for New England surrenders its charter.

1639—England grants to Gorges, new governor of New England, charter to land between Piscataqua and Kennebec rivers; territory to be called Maine.

1640—Thomas Gorges, Sir Ferdinando's son, presides over first general court of the province meeting at Saco.

1641—Gorgeana (York) chartered, America's first chartered city.

1647—Kittery, first town in Maine, is organized. Gorges dies; townsmen fail to set up self-rule.

1652—Massachusetts Bay Colony agrees to govern Maine settlements; Maine settlers send representatives to Massachusetts General Court, 1653.

1658—Southern Maine becomes County of Yorkshire.

1660—Ferdinando Gorges, grandson of Sir Ferdinando, claims Maine; Maine restored to Gorges, 1664.

1667—By Treaty of Breda, England cedes Nova Scotia to France; French claim Penobscot as part of cession.

1668—Sir Edmund Andros seizes Penobscot; Massachusetts again takes control of Maine.

1674—Area from Massachusetts to Penobscot Bay reorganized as County of Devonshire.

1675—Indians attack Maine settlers in King Philip's War; Saco, Scarboro, Casco, Arrowsic, and Pemaquid sacked and burned; war ends, 1678.

1678—Massachusetts buys Gorges' claims to Maine; forms provincial government for Maine, 1680.

1686—Dominion of New England established; includes Maine.

1688—Indian attack on North Yarmouth leads to King William's War, 1689; Maine and Massachusetts settlers form independent government, 1689; all but four Maine settlements destroyed by 1691.

1691—New Massachusetts charter gives greater self-government to Maine settlers.

1696—Father Sebastian Rasle opens first school in Maine on Kennebec River.

1697—Peace of Ryswick ends King William's War.

1701—Queen Anne's War begins; war lasts until 1713.

1713—France cedes to Great Britain all claims to Acadia.

1730—Last of Jesuit priests in Maine leave.

1739—Present Maine-New Hampshire boundary fixed.

1744—King George's War begins; fort at Louisbourg on Cape Breton captured 1745; war ends, 1748.

1755—Acadians are dispersed; many settle in Maine.

1759—With fall of Quebec, final peace with French and Indians achieved; Penobscot country is occupied; treaty signed with Indians, 1760.

1775—British burn Falmouth (now Portland).

1776—John Paul Jones's *Ranger* launched at Kittery.

1783—Peace settlement with Great Britain fixes Maine's eastern boundary along St. Croix River.

1794—Bowdoin College founded at Brunswick; opened, 1802.

1799—Portland Bank, first in Maine, is chartered.

1807—Embargo Act forces development of industries.

1814—During War of 1812, British occupy Maine coast; peace treaty restores old Maine-Canada boundary.

1820—Maine admitted to the Union, March 15, under the Missouri Compromise; governor, William King; capital, Portland.

1822—First steamboat in Maine, the *Kennebec*, begins running between Portland and North Yarmouth.

1832—Augusta selected as the new state capital.

1835—First shoe factory in state opened at West Auburn.

1839—Maine and New Brunswick quarrel over northeastern boundary in bloodless "Aroostook War."

1842—Webster-Ashburton Treaty between U. S. and Great Britain settles northeastern boundary.

1846—First state prohibition act passed.

1862—Maine State College of Agriculture and Industrial Arts founded; opens, 1868, at Orono; becomes University of Maine, 1897.

1871—State prohibition law strengthened; entire act included in constitutional amendment, 1884.

1911—Direct primary, initiative, and referendum adopted.

1917—Ripogenus Dam on W. Branch of Penobscot R. completed.

1930—Wyman Dam on Kennebec River completed.

1934—State prohibition amendment repealed.

1939—Rebuilding of U. S. Navy booms Maine shipbuilding.

1947—Maine Turnpike completed, Kittery-Portland; extension to Augusta under construction, 1954.

1948—Margaret Chase Smith of Maine is first Republican woman senator in U. S. elected to full term.

1951—Legislature passes 2% retail sales tax, with food exempt, and ends state property tax.

MAINE

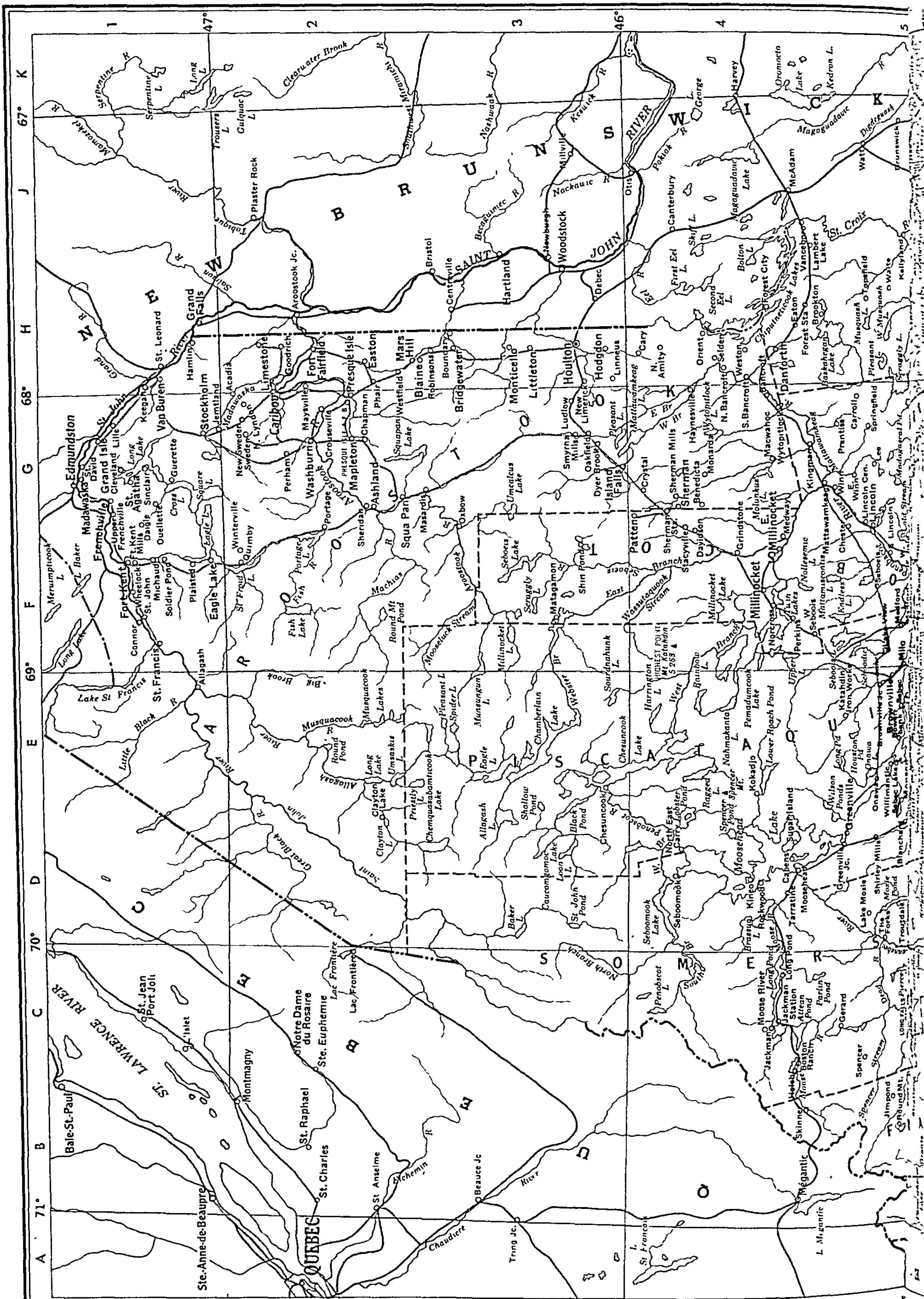
COUNTIES

Androscoggin 83,594 C 7
Aroostook 96,039 F 2
Cumberland 169,201 C 8
Franklin 20,682 B 5
Hancock 32,105 G 6
Kennebec 83,881 D 7
Knox 28,121 E 7
Lincoln 18,004 D 7
Oxford 44,221 B 6
Penobscot 108,198 F 5
Piscataquis 18,617 E 4
Sagadahoc 20,911 D 7
Somerset 39,785 C 4
Waldo 21,687 E 6
Washington 35,187 H 6
York 93,541 B 9

CITIES AND TOWNS

Abbot Village †462 E 5
Acton †473 B 8
Addison †846 H 6
Albion †992 E 6
Alexander †282 H 5
Alfred †1,112 B 9
Allagash †680 F 1
Allens Mills 175 C 6
Alna †350 D 7
Alton †314 F 5
Amherst †151 G 6
Andover †756 B 6
Anson †2,199 D 6
Appleton †671 E 7
Argyle †133 F 5
Ashdale 60 D 8
Ashland †2,370 G 2
Ashville 100 G 7
Athens †725 D 6
Atkinson †400 E 5
Atlantic G 7
Auburn 23,134 C 7
AUGUSTA 20,913 D 7
Aurora †91 G 6
Ayers J 6
Bailey Island 175 D 8
Bancroft †165 H 4
Bangor 31,558 F 6
Bar Harbor †3,864 G 7
Bar Mills 800 C 8
Baring †157 J 5
Bath 10,644 D 8
Bay Point D 8
Bayside F 7
Beals †590 H 7
Beddington †26 H 6
Belfast 5,960 F 7
Belgrade †1,099 D 7
Belgrade Lakes 450 D 6
Belmont †258 E 7
Bemis B 6
Benedicta †225 G 4
Benton †1,421 D 6
Berry Mills 100 C 6
Berwick †2,166 B 9
Bethel †2,367 B 7
Biddeford 20,836 C 9
Biddeford Pool C 9
Bingham †1,354 D 5
Birch Harbor H 7
Birches B 6
Blaine †1,118 H 2
Blanchard †75 D 5
Blue Hill †1,308 F 7
Bolsters Mills 115 B 7
Boothbay †1,559 D 8
Boothbay Harbor †2,290 D 8
Boundary 100 H 3
Bowdoinham †1,039 D 7
Bowerbank †20 E 5
Boyd Lake F 5
Bradford †793 F 5
Bradford Ctr. 150 F 5
Bradley †786 F 6
Bremen †409 E 8
Brewer 6,862 F 6
Bridgewater †1,279 H 3
Bridgton †2,950 B 7
Brighton †106 D 5
Bristol †1,476 E 8
Brooklin †546 F 7
Brooks †747 E 6
Brooksville †751 F 7
Brookton †206 H 4
Brownfield †612 B 8
Brownville †1,964 E 5
Brownville Jct. 1,086 E 5
Brunswick †10,996 C 8
Bryant Pond 500 B 7
Buckfield †899 C 7
Bucks Harbor 160 J 6
Bucksport †3,120 F 6
Burkettville 100 E 7
Burlington †425 G 5
Burnham †706 E 6
Buxton †2,009 C 8
Buxton Center B 8
Byron †96 B 6
Calais 4,589 J 5
Cambridge †326 E 5
Camden †3,670 F 7
Camp Ellis C 9
Canaan †785 D 6
Canton †746 C 7
Cape Neddick B 9
Cape Porpoise 400 C 9
Capens 1 D 4
Caratunk †96 C 5
Cardville 200 F 5
Caribou †9,923 G 2
Carmel †996 E 6
Carrabassett 10 C 5
Carroll †288 G 5
Carry Pond C 5
Carthage †339 C 6
Cary †278 H 4
Casco †881 B 7
Castine †793 F 7
Cedar J 5
Center Belmont E 7
Center Lovell B 7
Cen. Montville 175 E 7
Centerville †63 H 6
Chapman †381 G 2
Charleston †771 F 5
Charlotte †252 J 5
Chebeague Isl. 300 C 8
Chelsea †2,169 D 7
Cherryfield †904 H 6
Chester †256 F 5
Chesterville †588 C 6
Chesuncook 18 D 3
China †1,375 E 7
Chisholm 1,135 C 7
Citypoint E 7
Clark Island 175 E 8
Clarks Mill B 8
Clayton Lake 6 E 2
Cleveland 200 G 1
Cliff Island 125 C 8
Clifton †193 G 6
Clinton †1,623 D 6
Columbia †352 H 6
Columbia Falls †550 H 6
Cooper †128 H 6
Coopers Mills 239 E 7
Corea 156 H 7
Corinna †1,752 E 6
Cornish †795 B 8
Cornville †563 D 6
Costigan 158 F 5
Cranberry Isles †228 G 7
Crawford †83 H 5
Crescent Lake C 7
Criehaven 60 F 8
Crouseville 400 G 2
Crystal †373 G 4
Cumberland Center †2,034 C 8
Cumberland Mills C 8
Cundys Harbor 80 D 8
Curtis Corner C 7
Cushing †376 E 7
Cutler †483 J 6
Daigle G 1
Damariscotta †1,113 E 7
Danforth †1,174 H 4
Danville C 7
Darkharbor F 7
Davidson 45 F 4
Dayton †502 B 8
Deblois †59 H 6
Dedham †374 F 6
Deer Isle †1,234 F 7
Denmark †447 B 8
Dennysville †345 J 6
Derby 500 E 5
Detroit †492 E 6
Dexter †4,126 E 5
Dixfield †2,022 C 6
Dixmont †631 E 6
Dorman H 6
Dover-Foxcroft †4,218 E 5
Dover South Mills E 5
Dresden Mills 100 D 7
Dry Mills 220 C 8
Dryden 800 C 6
Dyer Brook †219 G 3
Eagle Lake †1,516 F 1
East Andover 150 B 6
E. Baldwin B 8
E. Blue Hill 200 G 7
E. Boothbay 500 D 8
E. Brownfield 130 B 8
E. Corinth 450 F 5
E. Dixfield 242 C 6
E. Dixmont E 6
E. Dover 67 E 5
E. Eddington 300 F 6
E. Franklin 78 G 6
E. Hiram 350 B 8
E. Holden F 6
E. Jackson E 6
E. Knox E 7
E. Lebanon B 9
E. Limington 150 B 8
E. Livermore 500 C 7
E. Lowell G 5
E. Machias †1,101 J 6
E. Madison 692 D 6
E. Millinocket †1,358 F 4
E. New Portland 43 D 6
E. Orland F 6
E. Otisfield 50 B 7
E. Parsonfield 175 B 8
E. Peru C 7
E. Pittston 1,050 D 7
E. Poland 490 C 7
E. Sebago B 8
E. Stoneham 300 B 7
E. Sullivan 250 G 6
E. Sumner 114 C 7
E. Union 190 E 7
E. Vassalboro 200 D 7
E. Waterboro 175 B 8
E. Waterford 175 B 7
E. Wilton 450 C 6
E. Winn 75 G 5
Easton †1,664 H 2
Eastport 3,123 K 6
Eaton 120 H 4
Eddington †664 F 6
Edgecomb †447 D 8
Edmunds †288 J 6
Eliot †2,509 B 9
Ellsworth 3,936 F 6
Ellsworth Falls 500 G 6
Elms B 9
Emery Mills 150 B 9
Enfield †1,196 F 5
Etna †458 E 6
Eustis †763 B 5
Exeter †734 E 6
Fairbanks 200 C 6
Fairfield †5,811 D 6
Fairfield Ctr. 150 D 6
Falmouth †4,342 C 8
Farmington †4,677 C 6
Farmington Falls D 6
Fayette †397 C 7
Five Islands 200 D 8
Forest City 27 H 4
Forest Station 30 H 4
Ft. Fairfield †5,791 H 2
Ft. Kent †5,343 F 1
Ft. Kent Mills 175 F 1
Fortunes Rocks 82 C 9
Frankfort †578 F 6
Franklin †709 G 6
Freedom †466 E 7
Freeport †3,280 C 8
Frenchboro 104 G 7
Frenchville †1,528 G 1
Friendship †772 E 7
Frye 150 B 6
Fryeburg †1,926 A 7
Gardiner 6,649 D 7
Garland †581 E 5
Georgetown †510 D 8
Gerard 20 C 5
Gilbertville 100 C 7
Gilead †140 B 7
Glen Cove 200 E 7
Glenburn †694 F 6
Goodrich H 2
Goodwins Mills 200 B 8
Goose Rocks Beach 135 C 9
Gorham †4,742 C 8
Gouldsboro 1,168 H 7
Grand Isle †1,230 G 1
Grand Lake Stream †294 H 5
Grants 9 B 5
Gray †1,631 C 8
Great Pond 40 G 6
Great Works F 6
Green Lake 40 F 6
Greene †974 C 7
Greenville †1,889 D 5
Greenville Junction 780 D 5
Grindstone 60 F 4
Grove 125 J 5
Guerette G 1
Guilford †1,842 E 5
Haines Landing B 6
Hale 60 B 6
Hallowell 3,404 D 7
Hamlin †430 H 1
Hampden †3,608 F 6
Hampden Highlands F 6
Hancock †755 G 6
Hanover †211 B 7
Harmony †709 D 6
Harpswell Ctr. 100 D 8
Harrington †853 H 6
Harrison †1,026 B 7
Hartford †381 C 7
Hartland †1,310 D 6
Haynesville †185 G 4
Hebron †829 C 7
Hermon 1,728 F 6
Highland Lake 100 C 8
Highpine 125 B 9
Hinckley 250 D 6
Hiram †804 B 8
Hodgdon †1,162 H 3
Holeb 54 C 4
Hollis Center 230 B 8
Hope †504 E 7
Houghton B 6
Houlton †8,377 H 3
Howland †1,441 F 5
Hudson †455 F 5
Hulls Cove 450 G 7
Indian River H 6
Intervale 45 C 8
Island Falls †1,237 G 3
Isle au Haut †82 F 7
Islesboro †529 F 7
Islesford 150 G 7
Jackman †964 C 4
Jackman Sta. 980 C 4
Jacksonville 300 J 6
Jay †3,102 C 7
Jefferson †1,215 D 7
Jemtland 100 G 1
Jimpond 8 B 5
Jonesboro †459 J 6
Jonesport †1,727 H 6
Katahdin Iron Works 15 E 5
Keegan 1,100 G 1
Kellyland 23 H 5
Kenduskeag †387 E 6
Kennebago Lake B 5
Kennebunk †4,273 B 9
Kennebunk Beach 125 C 9
Kennebunk Port †1,522 C 9
Kents Hill 170 D 7
Kezar Falls 1,400 B 8
Kineo †40 D 4
Kingfield †963 C 6
Kingman †358 G 4
Kingsbury †35 D 5
Kittery †8,380 B 9
Kittery Depot 1,220 B 9
Kittery Pt. 1,137 B 9
Knox †445 E 6
Kokadjo E 4
La Grange †511 F 5
Lake Moxie D 5
Lake View †23 F 5
Lambert Lake H 4
Lamoine †443 G 7
Lebanon †1,499 B 9
Lee †610 G 5
Leeds †797 C 7
Leeds Junction 54 C 7
Levant †706 F 6
Lewiston 40,974 C 7
Liberty †497 E 7
Lille G 1
Limerick †961 B 8
Limestone †2,427 H 2
Limington †851 B 8
Lincoln †4,030 G 5
Lincoln Center G 5
Lincolnville †881 E 7
Lincolnville Ctr. E 7
Linneus †777 H 3
Lisbon †4,318 C 7
Lisbon Ctr. 300 C 7
Lisbon Falls 2,155 D 7
Litchfield †953 D 7
Little Deer Isle 350 F 7
Littleton †1,001 H 3
Livermore †1,313 C 7
Livermore Falls †3,359 C 7
Locke Mills 380 B 7
Long Island 350 C 8
Long Pond 84 C 4
Longcove E 8
Loon Lake 10 B 5
Lovell †640 B 7
Lowell †192 F 5
Lubec †2,973 K 6
Ludlow †361 G 3
Machias †2,063 J 6
Machiasport †781 H 6
Macwahoc †131 G 4
Madawaska †4,900 G 1
Madison †3,639 D 6
Madrid †162 B 6
Mainstream D 6
Manchester †664 D 7
Mapleton †1,367 G 2
Mariner C 8

†Population of Township.



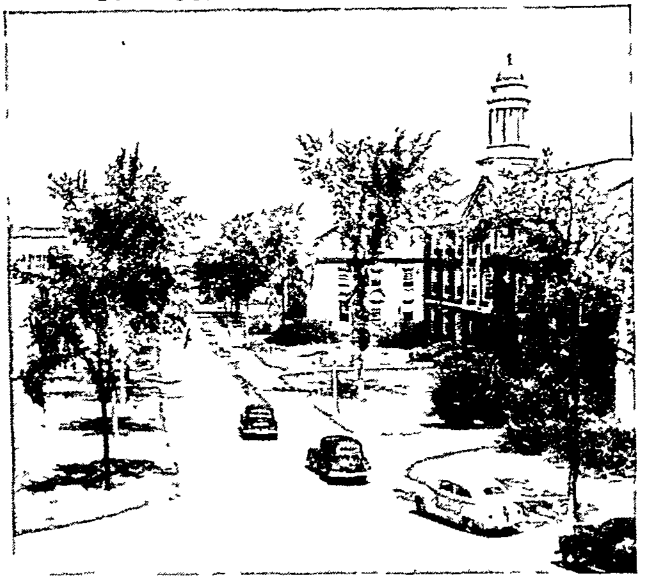
NEW BRUNSWICK
QUEBEC
AROOSTOOK
PISCATAQUIS
SOMERSET
PENOBSCOT
ST. LAWRENCE RIVER
SAINT JOHN RIVER
QUEBEC
Edmundston
Madawaska
Grand Isle
Van Buren
Caribou
Presque Isle
Fort Fairfield
Mars Hill
Houlton
Woodstock
Grand Falls
Fort Kent
Eagle Lake
Ashland
Washburn
Mapleton
Squa Pan
Patten
Sherman
Island Falls
Millinocket
Danforth
Kingman
Lincoln
Milo
Greenville
Moosehead
Jackman
Megantic
Montmagny
St. Charles
Ste.-Anne-de-Beaupre
Baie-St.-Paul
St. Jean Port Joli
Notre Dame du Rosaire
Ste. Euphemie
St. Raphael
St Anselme
Beauce Jc
Tring Jc.
Lac Frontiere
Chesuncook
Moosehead
Hartland
McAdam
Vanceboro
Harvey
HIGHEST POINT Mt. Katahdin 5 268

MAINE—*Continued*

Mars Hill	†2,060	H 2
Masardis	†523	G 3
Matagamon	3	F 3
Matinicus	†188	F 8
Mattawamkeag	†803	G 4
Maysville	150	G 2
McKinley		G 7
Mechanic Falls	†2,061	C 7
Meddybemps	†109	J 5
Medford	†191	F 5
Medford Ctr.	25	F 5
Medway	†725	G 4
Mercer	†348	D 6
Mexico	†4,762	B 6
Michaud		F 1
Middledam	25	B 6
Milbridge	†1,199	H 6
Milford	†1,435	F 6
Millinocket	†5,890	F 4
Milltown		J 5
Milo	†2,898	F 5
Minot	†750	C 7
Minturn	134	G 7
Monarda	250	G 4
Monhegan	†75	E 8
Monmouth	†1,683	D 7
Monroe	†593	E 6
Monson	†855	E 5
Monticello	†1,284	H 3
Montville	†466	E 7
Moody		B 9
Moose River	†203	C 4
Moosehead	17	D 4
Morrill	†306	E 7
Mt. Desert	†1,776	G 7
Mt. Vernon	†653	D 7
Naples	†747	B 8
New Gloucester	†2,628	C 8
New Harbor	500	E 8
New Limerick	†543	G 3
New Portland	†733	C 6
New Sharon	†755	C 6
New Sweden	†827	G 2
New Vineyard	†447	C 6
Newagen		D 8
Newburgh	†599	F 6
Newcastle	†1,021	D 7
Newfield	†355	B 8
Newport	†2,190	E 6
Nobleboro	†654	D 7
Norcross	46	F 4
Norridgewock	†1,784	D 6
N. Amity	250	H 4
N. Anson	1,000	D 6
N. Bancroft	71	G 4
N. Belgrade	200	D 7
N. Berwick	†1,655	B 9
N. Bradford	25	F 5
N. Bridgton		B 7
N. Brooksville	190	F 7
N. Buckfield		C 7
N. Cutler		J 6
N. Dexter	60	E 5
N. Dixmont		E 6
N. East Carry	13	D 4
N. Ellsworth		G 6
N. Fryeburg	200	B 7
N. Gorham	500	C 8
N. Haven	†410	F 7
N. Islesboro		F 7
N. Jay	550	C 6
N. Lebanon		B 9
N. Leeds	47	C 7
N. Limington	150	B 8
N. Livermore	145	C 7
N. Lovell	85	B 7
N. Lubec	150	J 6
N. Lyndon	200	G 2
N. New Portland	350	C 6
N. Newry	100	B 6
N. Parsonfield	67	A 8
N. Penobscot	150	F 7
N. Perry		J 5
N. Raymond	50	C 8
N. Searsmont	150	E 7
N. Shapleigh	90	B 8
N. Sullivan	850	G 6
N. Turner	232	C 7
N. Vassalboro	1,000	D 7
N. Waldoboro		E 7
N. Waterboro	500	B 8
N. Waterford	450	B 7
N. Wayne		C 7
N. Whitefield	200	D 7
N. Windham	500	C 8
N. Yarmouth	†942	C 8
Northeast Harbor	700	G 7
Northfield	†75	H 6
Northport	†574	E 7
Norway	†3,811	B 7
Norway Lake	150	B 7
Oakfield	†1,009	G 3
Oakland	†2,679	D 6
Ocean Park		C 9
Ogunquit	800	B 9
Olamon	600	F 5
Old Orchard Beach	†4,707	C 9
Old Town	8,261	F 6
Onawa	25	E 5
Oquossoc		B 6
Orient	†176	H 4
Orland	†1,155	F 6
Orono	†7,504	F 6
Orrington	†1,895	F 6
Orrs Island	450	D 8
Otisfield	†599	B 7
Otter Creek	1,000	G 7
Ouellette		G 1
Owls Head	†784	F 7
Oxbow	†189	G 3
Oxford	†1,569	C 7
Palermo	†511	E 7
Palmyra	†965	E 6
Paris	†4,358	B 7
Parkman	†590	D 5
Passadumkeag	†331	F 5
Patten	†1,536	F 4
Pejepscot		D 8
Pemaquid		E 8
Pemaquid Beach		E 8
Pembroke	†998	J 6
Penobscot	†699	F 7
Perham	†572	G 2
Perkins	†5	F 4
Perry	†613	J 6
Peru	†1,080	C 6
Phair	150	G 2
Phillips	†1,088	C 6
Phippsburg	†1,134	D 8
Pine Point	650	C 8
Pittsfield	†3,909	E 6
Pittston	†1,258	D 7
Plaisted	300	F 1
Pleasant Island		B 5
Pleasant Pond	11	D 5
Plymouth	†496	E 6
Poland	†1,503	C 7
Poland Spring	500	C 7
Popham Beach		D 8
Port Clyde	350	E 8
Portage	†542	G 2
Porter	†1,052	B 8
Portland	77,634	C 8
Pownal	†752	C 8
Prentiss	†315	G 5
Presque Isle	†9,954	H 2
Princeton	†865	H 5
Prospect	†392	F 6
Prospect Harbor	270	H 7
Prouts Neck	2,000	C 9
Pulpit Harbor	25	F 7
Quimby		F 2
Randolph	†1,733	D 7
Rangeley	†1,228	B 6
Raymond	†620	B 8
Readfield	†1,022	D 7
Red Beach		J 5
Redding	11	B 7
Richmond	†2,217	D 7
Richmond Corner	43	D 7
Ridlonville	2,000	C 6
Riley	175	C 6
Ripley	†389	E 5
Robbinston	†554	J 5
Robinsons	350	H 3
Rockland	9,234	E 7
Rockport	†1,656	F 7
Rockville	265	E 7
Rockwood	300	D 4
Rome	†420	D 6
Roque Bluffs	†80	H 6
Round Mountain	3	B 5
Round Pond	500	E 8
Roxbury	†348	B 6
Rumford	†9,954	B 6
Rumford Ctr.	300	B 7
Rumford Pt.	200	B 6
Sabattus	1,216	C 7
Saco	10,324	C 9
St. Agatha	†1,512	G 1
St. Albans	†1,035	E 6
St. David	1,000	G 1
St. Francis	†1,384	E 1
St. George	†1,482	E 7
St. John	†569	F 1
Salem	†67	C 6
Sandy Creek		B 7
Sandy Point	250	F 7
Sanford	†15,177	B 9
Sangerville	†1,161	E 5
Saponac	25	G 5
Scarboro	†4,600	C 8
Seal Cove		G 7
Seal Harbor	400	G 7
Searsmont	†558	E 7
Searsport	†1,457	F 7
Sebago	†577	B 8
Sebago Lake	346	B 8
Sebec	†442	E 5
Sebec Lake	7	E 5
Sebec Station	23	E 5
Seboeis	†70	F 5
Seboomook	†18	D 4
Sedgwick	†614	F 7
Selden	25	H 4
Shapleigh	†531	B 8
Shawmut	1,200	D 6
Sheepscott	100	D 7
Sheridan	310	F 2
Sherman	†1,029	G 4
Sherman Mills	1,030	G 4
Sherman Sta.	400	F 4
Shin Pond	17	F 3
Shirley Mills	250	D 5
Sidney	†918	D 7
Silvers Mills	55	E 5
Sinclair	800	G 1
Skinner		B 4
Skowhegan	†7,422	D 6
Small Point Beach		D 8
Smithfield	†354	D 6
Smyrna Mills	650	G 3
Soldier Pond		F 1
Solon	†746	D 6
Somerville	†227	D 7
Sorrento	†201	G 7
S. Acton	200	B 9
S. Addison	170	H 6
S. Bancroft		G 4
S. Berwick	†2,646	B 9
S. Blue Hill	141	F 7
S. Brewer		F 6
S. Bridgton	125	B 8
S. Bristol	†631	D 8
S. Brooksville	140	F 7
S. Casco	150	B 8
S. China	310	D 7
S. Deer Isle	85	F 7
S. Eliot	1,331	B 9
S. Exeter	25	E 6
S. Harpswell	300	C 8
S. Hiram	250	B 8
S. Hollis	30	B 8
S. Hope	125	E 7
S. Jefferson		D 7
S. La Grange	150	F 5
S. Lebanon		A 9
S. Levant	110	E 6
S. Liberty	47	E 7
S. Lincoln	164	G 5
S. Monmouth		D 7
S. Orrington	300	F 6
S. Paris	2,067	C 7
S. Penobscot		F 7
S. Portland	21,866	C 8
S. Robbinston		J 5
S. Sanford	600	B 9
S. Thomaston	†654	E 7
S. Union		E 7
S. Waldoboro		E 7
S. Warren		E 7
S. Waterford		B 7
S. Windham	1,569	C 8
Southport	†435	D 8
Southwest Harbor	†1,534	G 7
Spencer		C 5
Springfield	†414	G 5
Springvale	2,745	B 9
Squa Pan	75	G 2
Stacyville	†679	F 4
Standish	†1,786	B 8
Starks	†421	D 6
Steep Falls	480	B 8
Stetson	†434	E 6
Steuben	†784	H 6
Stillwater	800	F 6
Stockholm	†641	G 1
Stockton Sprs.	†949	F 7
Stonington	†1,660	F 7
Stow	†147	A 7
Stratton	560	B 5
Strong	†1,036	C 6
Sugar Island	4	D 4
Sullivan	†762	G 6
Sumner	†526	C 7
Sunset		F 7
Sunshine	120	G 7
Surry	†448	F 7
Swans Island	†468	G 7
Swanville	†437	E 6
Sweden	†212	B 7
Sweden		G 2
Tarratine	8	D 4
Temple	†284	C 6
Tenants Harbor	400	E 8
The Forks	†45	D 5
Thomaston	†2,810	E 7
Thorndike	†534	E 6
Topsfield	†231	H 5
Topsham	†2,626	D 8
Tremont	†1,115	G 7
Trenton	†358	G 7
Trescott	†362	J 6
Trevett	350	D 8
Troutdale	25	D 5
Troy	†553	E 6
Turner	†1,712	C 7
Turner Center		C 7
Union	†1,085	E 7
Unionville	150	H 6
Unity	†1,014	E 6
Upper Dam		B 6
Upper Frenchville	500	G 1
Upper Gloucester	150	C 8
Upton	†105	B 6
Van Buren	†5,094	G 1
Vanceboro	†497	H 4
Vassalboro	†2,261	D 7
Veazie	†776	F 6
Vienna	†231	D 6
Vinalhaven	†1,427	F 7
Waite	†117	H 5
Waldo	†324	E 7
Waldoboro	†2,536	E 7
Walnut Hill	250	C 8
Waltham	†154	G 6
Warren	†1,576	E 7
Washburn	†1,913	G 2
Washington	†722	E 7
Waterboro	†1,071	B 8
Waterford	†828	B 7
Waterville	18,287	E 6
Wayne	†459	D 7
Webhannet		C 9
Weeks Mills	100	E 7
Welchville		C 7
Weld	†361	C 6
Wellington	252	D 5
Wells	†2,321	B 9
Wells Beach		C 9
Wesley	†149	H 6
W. Athens	175	D 6
W. Baldwin		B 8
W. Bath	†578	D 8
W. Bethel	250	B 7
W. Boothbay Harbor		D 8
W. Brooksville	140	F 7
W. Buxton	350	B 8
W. Enfield		F 5
W. Falmouth	1,500	C 8
W. Farmington	500	C 6
W. Franklin	115	G 6
W. Gardiner	†946	D 7
W. Garland	50	E 5
W. Gorham		C 8
W. Gouldsboro	105	G 7
W. Hampden		E 6
W. Harpswell	100	C 8
W. Jonesport	850	H 6
W. Kennebunk		B 9
W. Lebanon	150	B 9
W. Lubec		J 6
W. Mills	50	C 6
W. Minot	300	C 7
W. Newfield	175	B 8
W. Old Town	35	F 6
W. Paris	800	B 7
W. Pembroke	500	J 6
W. Penobscot		F 7
W. Peru	300	C 7
W. Poland		C 7
W. Ripley		E 6
W. Rockport	200	E 7
W. Scarboro	1,500	C 8
W. Seboois		F 4
W. Sumner	101	C 7
W. Tremont	250	G 7
W. Winterport	30	E 6
Westbrook	12,284	C 8
Westfield	†557	G 2
Weston	†248	H 4
Wheelock		F 1
Whitefield	†1,030	D 7
Whiting	†354	J 6
Whitneyville	†227	H 6
Willimantic	†189	E 5
Wilsons Mills	80	B 6
Wilton	†3,455	C 6
Windsor	†740	D 7
Winn	†497	G 5
Winnecook	35	E 6
Winslow	†4,413	D 6
Winslows Mills	200	E 7
Winter Harbor	†568	G 7
Winterport	†1,694	F 6
Winterville	†373	F 2
Winthrop	†3,026	C 7
Wiscasset	†1,584	D 7
Woodland	†1,292	H 5
Woolwich	†1,344	D 8
Wyman Dam	451	D 5
Wytopitlock	352	G 4
Yarmouth	†2,669	C 8
York	†3,256	B 9
York Beach	500	B 9
York Corners	100	B 9
York Harbor	750	B 9

†Population of Township.

THE UNIVERSITY OF MAINE



The tower of Winslow Hall looms over the beautiful landscaped campus of the University of Maine overlooking the Stillwater River at Orono. The State University was incorporated in 1865.

of the country came from Maine. With the decline of the use of wooden vessels, the industry decreased, and not until World War I did Bath again come into prominence as a shipbuilding center.

The fisheries of Maine are second only to those of Massachusetts among the New England states. Lobsters account for about half the value of Maine's total catch. Ocean perch (rosefish) are next in value. Also important are herring, clams, haddock, hake, and cod.

A variety of minerals are found in the old worn-down mountains, but many deposits are too small to be workable. The most valuable of the mineral products are cement, stone, sand and gravel, and slate. Granite has always been one of Maine's principal minerals. It is much in demand for buildings and monuments because of its varied color, grain, and texture. Limestone is most important in the Penobscot Bay area. Other minerals of value are feldspar, peat, clays, mica, beryllium, lime, lithium minerals, quartz, columbiun, and gem stones.

Cities and Education

Portland, the largest and wealthiest city in the state, as well as one of the most beautiful in all New England, is renowned as the birthplace and early childhood home of Longfellow. Many densely shaded avenues have earned for it the title Forest City. It is picturesquely situated on a peninsula extending into the island-dotted Casco Bay.

The harbor of Portland is one of the deepest and safest natural harbors on the Atlantic coast. During World War II it was used as the base of the Navy's North Atlantic fleet. At that time two large shipyards at South Portland turned out several hundred cargo ships. Portland has a variety of large industries. Many of these are based on the nearby natural resources of lumber, fisheries, and farm products.

Lewiston, second city in size, looks across the banks of the Androscoggin River to Auburn. These municipalities are really one large community in all respects except government; they form an important industrial center. Close by are an important group of thriving towns and a fertile agricultural region. Large manufacturing plants produce textiles and shoes.

Along the same river is Brunswick, home of Bowdoin College, founded in 1794. Here Longfellow studied with his college mates, Franklin Pierce, later president of the United States, and Nathaniel Hawthorne. Here Longfellow was a professor for seven years. The University of Maine is at Orono. Other institutions include Bates College at Lewiston; Colby College at Waterville; Portland and Westbrook junior colleges, both at Portland; Ricker College at Houlton. State teachers colleges are at Presque Isle, Farmington, Fort Kent, Machias, and Gorham.

Many old academies, forerunners of the present high schools, still exist. Notable is Fryeburg Academy, at Fryeburg, where Daniel Webster taught.

The Climate and Summer Resorts

Maine's climate is cooler than might be expected from its latitude, because of currents from the North Atlantic. Maine people, however, find steady cold agreeable. Thousands of visitors are attracted to Maine during the summer months because the heat is tempered by sea breezes and cool winds from the north. The state has often been called the Summer Playground of the East. One of Maine's most popular vacation resorts, Bar Harbor, located on Mount Desert Island, suffered a disastrous forest fire in 1947 that nearly destroyed the entire community, reducing magnificent homes and estates to ashes. On Mount Desert Island is Acadia National Park, the first national park in the eastern states. It includes most of the island's mountains, some of which rise out of the ocean itself to a height of more than 1,500 feet. Near New Hampshire are the beautiful Rangeley Lakes, 1,000 feet above sea level—the fisherman's paradise; and farther north is Maine's largest lake, Moosehead. The old fort at Pemaquid, held at different

MAINE'S HANDSOME STATEHOUSE

The State Capitol of Maine rises upon a knoll above Augusta. It was built of white granite from Hallowell, Me., in 1829-32. The statue on top of the dome symbolizes Augusta, the city.

times either by the French or the English and thrice rebuilt, is preserved in Fort William Henry Memorial, at Pemaquid Beach.

Various explorers touched the coast of Maine in the 16th and the early part of the 17th centuries, and in these years both France and England claimed the territory. Maine was once a part of Acadia, famous in song and story. This name was given to the vast grant of land along the east coast, from about New Jersey to Newfoundland, which Henry IV of France set aside for colonization by the adventurous De Monts in 1603. The latter, with Champlain and others, explored the coast in 1604. Maine was also included in the territory granted to the Plymouth Company in 1606 by King James I.

PORTLAND—THE METROPOLIS OF MAINE

This air view looks northward over the city, showing the business section on a promontory, with the harbor in the foreground opening on Casco Bay. The city runs around the smaller bay at the upper left and includes the area visible beyond it.

First Attempt at Colonization

Colonists with George Popham as their leader landed at the mouth of the Kennebec River in the summer of 1607. They built a fort, 15 cabins, a church, and a storehouse. Courageous, but unaccustomed to severe winter weather, most of them returned with the supply ship in December. The rest built the *Virginia,* the first ship constructed by Englishmen in North America. Before they embarked in the spring of the next year, however, their brave leader had died.

French colonization was likewise unsuccessful in this period, and before the first quarter of the 17th century had passed the English were in control.

In 1622, Sir Ferdinando Gorges and John Mason secured a grant in what is now southern Maine from the Council for New England, successor to the Plymouth Company. Well-organized groups of colonists established permanent settlements at York, Saco, Falmouth (now Portland), Cape Elizabeth, Scarborough, and Biddeford. In 1652, Massachusetts began reaching into the territory and annexed towns and bought tracts of land from the Gorges heirs. When a new charter was given the Massachusetts colony in 1691, Maine was a part of it. During the next 75 years colonization continued in the face of bitter conflicts of the New England colonists against the French and the Indians. In these, Maine played an important part. It was Sir William Pepperell, a native of Maine, who took the French Fortress of Louisbourg in 1745.

During the Revolution, the British burned Falmouth. Benedict Arnold traveled up the Kennebec and Dead rivers in his luckless march on Quebec. Ships rotted at Maine's docks during the Embargo and Non-Intercourse acts of 1807-9. During the War of 1812, the British plundered Bangor, Eastport, Castine, Belfast, and Hampden.

A Missouri Compromise State

Maine was governed by Massachusetts under the name of the District of Maine until March 15, 1820, when it was admitted into the Union as a separate state under the Missouri Compromise (*see* Missouri Compromise).

The boundary on the north was long disputed by the United States and Canada. In the treaty at the close of the Revolutionary War the boundaries had been defined in a way that looked very well on paper. However, the two countries could not agree where they actually should be placed, for the St. Croix River named in the treaty was not the true St. Croix. Furthermore, Canadian lumber cutting in the disputed district of the Aroostook River (now in northeastern Maine) threatened serious difficulty. Although no gun was fired, the long-continued quarrel is known as the Aroostook War. At one time Maine called out the militia and New Brunswick sent two regiments of British regulars. Finally, the Webster-Ashburton Treaty of 1842 divided the region almost equally between the two nations, and thus the dispute ended. (For additional history, *see* chronology in Maine Fact Summary.)

The Government of Maine

Maine still uses its first constitution, adopted in 1820. The governor and the legislators, serving two-year terms, are elected by the people. The governor is advised by an executive council of seven members. The legislature elects the council, the secretary of state, and other executive officers. The governor appoints the supreme and superior court judges, subject to approval of the council. The people of Maine may use the initiative and referendum for legislative acts.

"As Maine goes, so goes the country," is a political byword, for Maine holds its state elections in September, two months before the usual elections in all other states, which come in November.

Maine's Roster of Notables

Maine counts among its noted men James G. Blaine, twice the nation's secretary of state (*see* Blaine); Nelson Dingley, Jr., author of the Dingley Tariff Law of 1896; Thomas B. Reed, Republican leader; Hannibal Hamlin, vice-president during Lincoln's first term; Cyrus H. K. Curtis, publisher; Neal Dow, temperance leader; John Knowles Paine, composer; Melville W. Fuller, chief justice of the United States Supreme Court; and Lincoln Colcord, author of sea stories. Two famous humorists, Edgar Wilson Nye (Bill Nye) and Artemus Ward (Charles Farrar Browne), were born in Maine; as were Sarah Orne Jewett, writer of New England tales; and the poets Henry Wadsworth Longfellow, Edwin Arlington Robinson, and Edna St. Vincent Millay.

Harriet Beecher Stowe wrote 'Uncle Tom's Cabin' at Brunswick. Kate Douglas Wiggin and John Kendrick Bangs wrote in Maine for years. Maine was the birthplace of Lillian Nordica, famous opera soprano. The Maxim brothers—Hudson, inventor of explosives and Sir Hiram, inventor of an automatic machine gun—were born in Maine. (*See also* United States, section "New England.")

MAINTENON, MARQUISE DE (1635–1719). The life of clever, determined Françoise d'Aubigné is a rags-to-riches story. Born in prison and left a poor orphan at the age of seven, she became the famous Marquise de Maintenon, and later the wife of the French king, Louis XIV.

Passed from one relative to another, the child had difficulty getting an education. At 16, she married the deformed poet, Scarron, and became hostess and friend to French writers and artists. After his death she was appointed governess to two sons of Louis XIV. She moved to the court at Versailles, and in 1678 was given the title Marquise de Maintenon.

Her influence over the king soon became apparent. She helped to reconcile him with his queen, who thanked her for receiving kind treatment from the king after 20 years of neglect. After Maria Theresa's death, Louis privately married the Marquise. Though she did not hold the rank of queen, her influence was supreme. She turned the king's thoughts toward the church and reformed the scandalous court life. Her political advice was often wrong. Her letters portray her life vividly.

Remembering her unhappy childhood, she founded Saint-Cyr, a school for poor girls of good families. After the king's death she retired to the school to spend her last years and was buried in its choir.

LIVING IN MALAYA'S HOT, RAINY CLIMATE

Malay builders made this house from bamboo, palm-leaf thatching, and other materials growing nearby. They stood it on stilts to lift the floor from the wet mud, to keep out crawling snakes and insects, and to let air dry and cool it.

The clothing of these Malay city children shows the influence of their Chinese neighbors. Notice the straight hair and slanting eyes characteristic of Malays

MALAY PENINSULA. Half of the world's rubber and a third of its tin come from southern Asia's tropical Malay Peninsula. Transportation and industry around the globe were threatened when its exports were shut off by Japanese conquest during the second World War. Yet the peninsula is small—only a little larger than Alabama—its land is mountainous, and three-quarters of it is covered with tangled rain forest. It is about 750 miles long and only 200 miles at its widest place.

This slender finger of land extends south and southeast from the larger Indo-Chinese peninsula, dividing the South China Sea from the Indian Ocean. It lies amid the East Indies Islands, sometimes called the Malay Archipelago. Its tip is continental Asia's southernmost point. Singapore, just off the tip, lies only 75 miles north of the equator. The Federa-

tion of Malaya, in the bulb-shaped southern end, is the peninsula's principal political division. A British protectorate, its area is 50,850 square miles, and its population 4,908,086 (1947 census). In the north are strips of Siam and Burma. (For map, *see* Indo-China.)

Rain, Heat, and Tropical Vegetation

The weather is hot, oppressively humid, and rainy throughout the year. Plants grow so rapidly that it is hard to clear land and keep down weeds and undergrowth. Only the best soil and most nearly level land of the valleys and coastal plains are cultivated. The region west of the central mountain ranges is best developed. Here are the leading rubber plantations and tin mines and the chief roads and railways. The big ports are on Singapore and Penang islands.

A SAKAI GIRL OF THE JUNGLE

This graceful child of the forest looks bewildered on her first visit to a village. She is dressed in the typical Malay sarong.

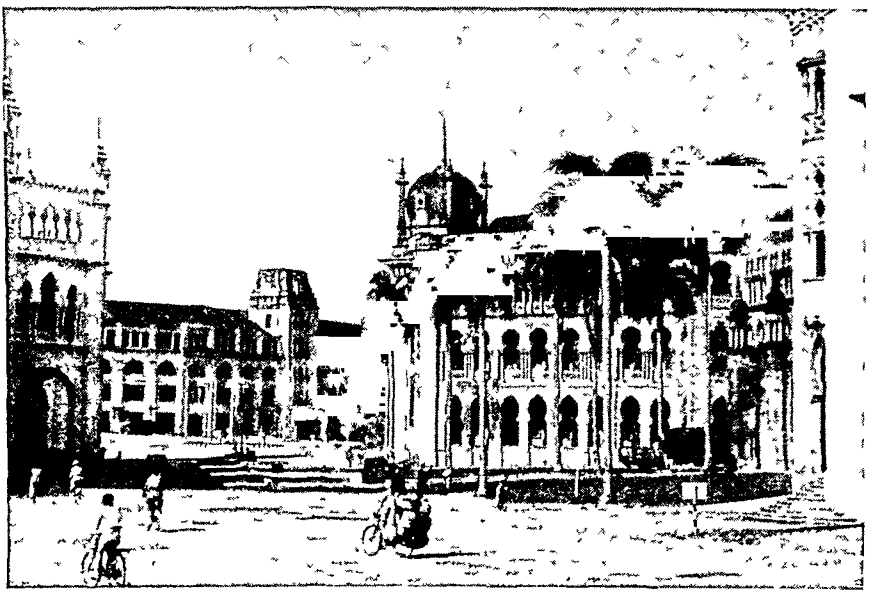
The mountains of the interior—rising above 7,000 feet—are smothered in jungles and drained by many short, swift rivers. The bare trunks of giant trees tower 150 feet to a canopy of leaves. Underbrush and tree ferns spread over the soggy ground. Tough vines and rattan palm stems twist together in an almost impassable net. The larger jungle animals make their way through the wood by following trampled trails, and the multitude of monkeys and apes swing from tree to tree. Among the great beasts are Asiatic elephants, rhinoceroses, tigers, panthers, leopards and other jungle cats, and the black bison or buffalo. The many reptiles include the python, cobra, and crocodile. Myriad birds and bright moths and butterflies lend color to the deep green foliage. Swarming insects torment men and animals.

How the People Live

Varied peoples live in Malaya. The native Malays make up but two-fifths of the population They are short, usually slende people, with dark brown skin, straight black hair, and bright black eyes. Their religion is Mohammedanism. They are hospitable, cheerful, and courteous. But long dwelling in the hot, humid climate has helped to make them unambitious — even lazy. They like bright colors. Men and women drape a gay *sarong*, or wrapped skirt, about their waists. Women add a *baju*, or blouse, and a head veil. The men may wear thin cotton trousers and shirt and a turban.

Most Malays are peasant farmers, who raise rice in irrigated paddies (*see* Rice). They hitch a water buffalo to a crude plow to break the sod. Men and women work for hours in the flooded fields when they transplant the rice shoots. Their homes are in villages, called *kampongs*. The airy houses are lifted high off the muddy ground on posts. Around the house grow coconut palms and such tropical fruit trees as the mango, the mangosteen, and the durian. Some Malay farmers have small coconut or rubber groves. People of the seacoast villages catch and dry fish for a living. Rice and fish are the chief foods of the Malays. The women flavor the rice with peppers and use hot, spicy sauces.

THE CAPITOL OF THE FEDERATION OF MALAYA



Moorish influence is seen in the architecture of the capitol at Kuala Lumpur, on the right, and the railway station and hotel, on the left. This modern city in the heart of the tin-mining district was made the administrative capital of the Federation in 1948.

When the British and other non-Malayan people began developing tin mines and rubber plantations, they brought in Chinese workers and Tamils from southern India. Today immigrants and their Malay-born children outnumber the Malays. The Tamils make up about one-tenth of the population and the Chinese about two-fifths. The wealthier Chinese are merchants and mine and plantation owners.

People of the Jungles

Deep in the rain forest dwell primitive peoples, who

live by hunting, fishing, and gathering roots, nuts, and fruits, as their savage forefathers did many centuries ago. The Semang are little black people with crisp, kinky hair, called Negritos. Constantly roaming in search of food, they have no permanent homes. They set up two forked sticks and lay a pole between them. Then they lean leafy branches against the pole. This shed, or lean-to, keeps out the beating rain and they need no walls for warmth. They wear no clothing or just a loin cloth of inner bark.

The women make most of their few utensils from the hollow stems of bamboo (*see* Bamboo). They can carry water or store seeds or berries in a bamboo tube and cook in the green stem. Banana leaves serve as plates and "wrapping paper." The women use sharp dibble sticks to dig wild yams and other roots.

The men lash bamboo poles together to make rafts. They make traps, to catch fish and animals, and bows and blowguns. The hunter dips the arrows and darts into the poison juice of the upas tree. He blows a dart from the hollow tube of his blowgun and hits a monkey chattering on a tree bough. The prick of the tiny dart does not seem to hurt the animal but soon it drops to the ground.

The Semang are shy little fellows. They slip away through the woods when hunters approach and have little contact with other people. They may trade enough to get the sharp knives and axes they need to chop away vines and bushes.

The Sakai—a people with lighter skins and wavy hair—have mixed with other Malays more than the Semang. In addition to hunting and gathering, they plant rice, cassava, and other crops in their small forest clearings. They have better homes than the Semang and decorate their bamboo utensils and their inner-bark cloth with graceful designs.

Trade and Industries

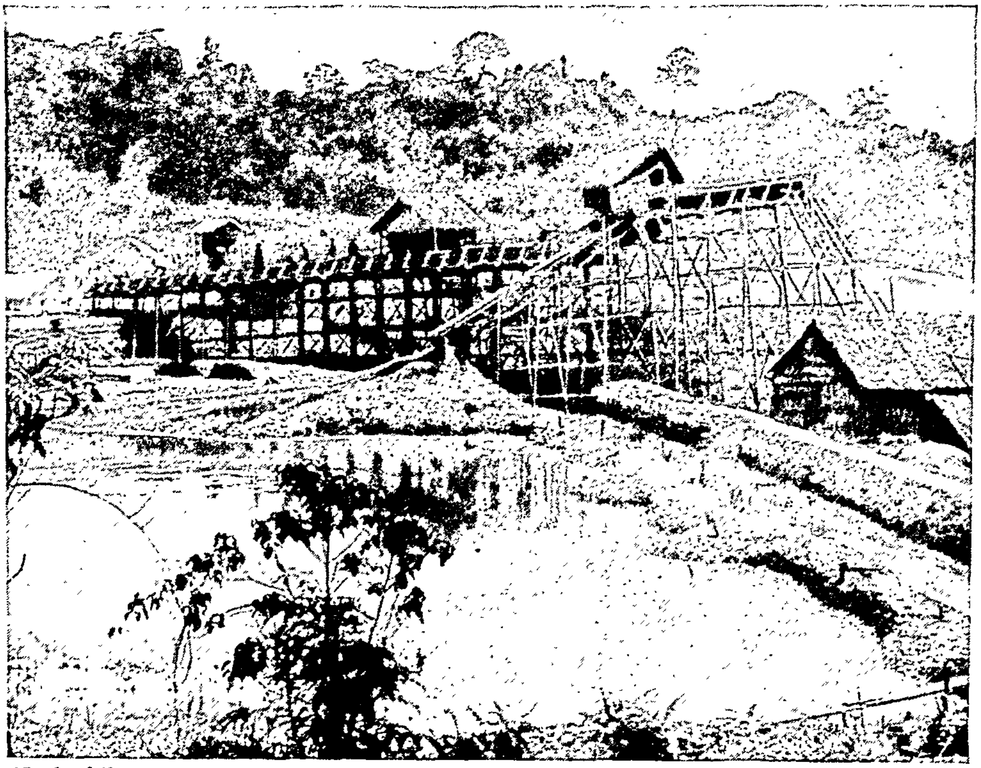
Malaya depends upon foreign trade. Its prosperity rises and falls with the world price of tin and rubber. The country must import rice, because the farmers raise only a third of the people's needs. Other commercial crops include coconuts, oil-palm nuts, pineapples, cassava for tapioca, gambier, and pepper.

Though tin is by far the most important mineral, some iron ore, gold, coal, manganese, bauxite, and phosphates are mined. Malaya has no large-scale manufacturing. Malaya has few factories; and most of these are for processing minerals and crops.

History and Government

Ten centuries or more ago, traders from India sailed to Malaya for spices and brought their religions—

TIN MINING—A LEADING INDUSTRY IN MALAYA



Much of the tin comes from alluvial deposits. After powerful jets of water gouge the ore-bearing soil from the ground, it is carried to the top of the runway by motor. It then courses down a series of steps which separate the tin "concentrate" from clay and sand.

IN SINGAPORE'S BUSY PORT

Here Malayan longshoremen helping to unload a freighter are given lunch on deck. The usual fare of curried rice and fish is served on a banana leaf and eaten with the fingers.

Hinduism and Buddhism. In the 13th and 14th centuries Mohammedans swept across the sea from Java and Sumatra, and Thais (Siamese) invaded from the north. The Portuguese in 1511 seized the strategic port of Malacca on the southern coast of the peninsula, where St. Francis Xavier came to preach. The Dutch ousted the Portuguese in 1641. The British entered in 1795. British and Dutch rivalry ended in 1824, when the two powers agreed to divide their colonial holdings at the Strait of Malacca.

Britain and Siam then controlled Malaya. Siam held the center and the north. Britain ruled the rest in a patchwork government formed by the Straits Settlements, the Federated Malay States, and the Unfederated Malay States. The capital was Singapore (*see* Singapore). All this territory was seized by Japan in 1942 and held until 1945 (*see* World War, Second).

In 1946 Britain, again in control, organized the states into a Malayan Union. But objections of the sultans who ruled the individual states led to the formation of the Federation of Malaya in 1948. It included all Malaya except Singapore, which remained a crown colony. Kuala Lumpur was made the capital.

Under the Federation, the sultans had greater power The Malays had more political rights than the economically powerful Chinese. Communists exploited Chinese resentment to launch a campaign of terrorism and guerrilla warfare, demanding independence.

MALT. Barley or other grain that has been artificially germinated or sprouted by moisture and heat is called malt. In the older and simpler method of malting the grain is steeped in cisterns from 48 to 100 hours at a temperature of about 55° F. It is then spread on a floor in heaps to germinate for several days and finally it is dried in kilns. In the malting process various ferments or enzymes are produced, especially *diastase*, which has the power of changing starch into sugar (*see* Enzymes).

Malt is largely used in making malted milk, which is a mixture of powdered milk and powdered malt. It is also used in making invalid and baby foods, for the starch of the grain is started toward digestion in the process of malting; some of it is actually changed into sugar and other products soluble in water. A solution of malt products, evaporated to a thick consistency until it looks like brown syrup, is used in bread making. Yeast producers use malt as food for the yeast plants. Much malt is used in brewing beer, which is made from a mixture of malt (chiefly barley malt), various unmalted grains, hops, and water.

MALTA. In June 1798 Napoleon Bonaparte, while on his way to Egypt, seized without resistance the small island of Malta, in the Mediterranean Sea. It was then ruled by the Knights of Malta—the last of the famous Crusading Orders of the Middle Ages. Three months later a British fleet, aided by Maltese rebels, besieged the garrison of French soldiers left behind by Bonaparte. The garrison held out for two years, but finally surrendered. Thus Great Britain came into possession of that important strategic point for naval control of the Mediterranean.

In the second World War, while the Axis had armies in North Africa, planes from Malta harassed supply ships bound for Tripoli. In return, the island was under almost constant bombardment from Axis planes. Its population huddled in caves and the British planes took shelter in underground hangars. But the island held out with the aid of supplies and ammunition brought from England by submarines. Its citizens received the George Cross for gallantry.

Inhabited originally by the ancient Mediterranean race, whose great stone monuments are still visible, Malta was colonized by the Phoenicians perhaps 900 years before the Christian Era. Then in succession through the centuries came Carthaginians, Romans, Byzantine Greeks; Saracens, Normans, and Spaniards, until Emperor Charles V in 1530 gave the island to the Knights Hospitalers of St. John. Adopting the title of Knights of Malta, they defended themselves against Turkish attack in the famous siege of Malta (1565) and maintained their rule until the surrender to Bonaparte in 1798.

Malta lies 58 miles south of Sicily and about 180 miles from the African coast. The island is only 17½ miles long and 8 miles broad, but near by are the smaller islands of Gozo and Comino which make the total area of the British colony 122 square miles.

The climate is temperate, and except for occasional outbreaks of Malta fever, due to a germ found in goat's milk, it is healthful. The country people, who cultivate tiny farms terraced up on the hillsides. are largely descendants of the early Phoenicians and speak a language of mixed Phoenician, Arabic, and Latin origin. There is a large group of Italians, Greeks, Turks, Jews, Arabs, and other nationalities. English is taught in the schools, but the official language of the law courts is Maltese.

Local government is administered by a British governor and a council of government, which is partly elected. The chief products are grains, potatoes, onions and other vegetables, cotton, and fruits; but food has to be imported to supply the needs of the dense population. The capital and chief port is Valletta. It has a magnificent harbor and contains many interesting buildings, notably the Grand Masters' Palace and St. John's Cathedral. Population of colony (1948 census), 305,991.

MAMMALS. Usually the word "animal" brings to mind a creature like a dog or a cow. We may think of birds or fishes or insects and realize that they are animals too. But usually we call them by these names. We think of an animal as a four-footed, warm-blooded creature with a furry coat.

This use of words matches the actual facts. Dogs, cats, cows, horses, and other four-footed, fur-coated creatures do stand apart from birds, fishes, insects, snakes, and various other creatures. They form the great class of *mammals*, and in many ways they are the most highly developed of all the animals.

The name mammal explains one important way in which creatures in this class are set apart from other animals. It comes from the Latin *mamma*, which means

HUGE MAMMALS OF THE CENOZOIC ERA

The lumbering Titanothere (top picture) had a big double horn on its nose. The catlike animals at the right were Creodonts. At the left are large land tortoises. The gigantic ground sloths (center) were twice as big as an elephant. The Glyptodont was a great armadillo-like beast with a war-club tail. The Entelodonts, or giant swine (bottom), stood 6 feet high at the shoulder. The Chalicotheres, shown eating tree leaves, had horselike heads and strong claws instead of hooves.

"breast." Every female mammal has breasts which secrete milk. She bears her young alive, and she feeds them with milk from her breasts until they have grown enough to get food for themselves.

During this time the young go about with their mother. They get used to hunting for food where she does, and they learn her ways of avoiding enemies. All this helps them greatly when they have to start living for themselves. This care of the young is one of the features which leads scientists to group all mammals as a separate class (*Mammalia*) in the animal kingdom.

Mammals are also the only animals which have developed hair as a protection against the weather; some water-dwelling mammals (whales) and others have only scanty hair; hedgehogs have transformed their hair into spines, and armadillos have changed part of theirs into bony plates or scales. Mammals are warm-blooded, in this respect resembling birds (which wear feathers in place of the mammals' fur) and differing from fishes, reptiles, and amphibians, which are cold-blooded.

In the most primitive type of mammals (*monotremes*), the young hatch from eggs, but feed on milk secreted from pores all over the mother's nipple-less breast. The duckbill and the echidna are monotremes (*see* Duckbill). The pouch-bearing mammals (*marsupials*), such as the kangaroo, bring forth living but undeveloped young. These immediately attach themselves to the mother's nipples in the pouch, where they are carried and nourished for many days until they can shift for themselves (*see* Kangaroo; Opossum). *Placental mammals* bring forth fully developed young, which are suckled and protected by the mother in the manner familiar to us in the case of all the higher animals, including man.

Orders of Mammals

The orders of placental mammals are the following: *Edentata* ("toothless" animals)—armadillo, hairy anteater, sloth; *Pholidota*—pangolin or scaly anteater; *Tubulidentata*—the aardvark; *Carnivora* (the flesh eater)—bear, badger, mink, dog, cat, tiger, lion, fox, hyena, walrus, seal, etc.; *Cetacea*—whales and dolphins; *Perissodactyla* (odd-toed hoofed animals)—ass, horse, zebra, tapir, rhinoceros; *Artiodactyla* (even-toed hoofed animals)—pig, cow, alpaca, camel, hippopotamus, deer, sheep, goat, etc.; *Hyracoidea*—hyrax or coney; *Proboscidea*—elephant; *Sirenia*—manatee and dugong; *Rodentia* (gnawers)—squirrel, hare, rabbit, rat, beaver, gopher, etc.; *Insectivora* (the insect-eaters)—mole, shrew, hedgehog; *Dermoptera*—flying lemur; *Chiroptera*—bat; *Primates* (the highest order)—lemur, monkey, ape, and man.

Mammoth and Mastodon. In various parts of the world are found the bones and other remains of these large elephant-like animals, which probably ceased to inhabit the earth before the beginning of historic times. In some of the caves of Europe are found drawings which show that men of the Stone Age hunted these monsters.

The difference between the mammoth and the mastodon seems to have been chiefly in the teeth.

AN EXCITING MOMENT IN PREHISTORIC TIMES

Here a number of our prehistoric ancestors have discovered a mammoth, and have wounded him. Undoubtedly they will make a feast of him in the end, but it will be at a cost of several lives.

Both were about the size of the largest Asiatic elephants of today, but unlike living elephants their tusks were curved upward and their bodies covered with hair. The mammoth especially had a shaggy mane. The largest tusks discovered are greater than 12 feet in length and weigh more than 250 pounds. Tusks are so abundant that they make up a considerable part of commercial ivory (*see* Ivory).

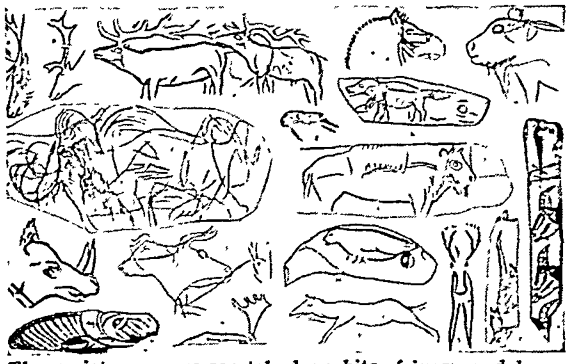
Long ago no one knew that huge animals had lived on earth and died out before historic times. So they made fanciful guesses about the bones of mammoths. Some said they were the bones of the Greek warrior Ajax; others thought they were the remains of Hannibal's elephants or of unicorns. In 1705 a mammoth's thighbone was dug up near Albany, N. Y., and its size convinced many people that a race of giants had once lived in this region. In Arctic Siberia and Alaska, whole carcasses of mammoths have been found frozen in the icy soil (*see* Food Preservation).

Mastodons and mammoths (as well as modern elephants) belong to the order *Proboscidea*. Mastodons (family *Mastodontidae*) originated in the Oligocene epoch and remained on earth through the Pleistocene (*see* Geology). They spread from Africa through Europe, Asia, and North America; some even reached South America. Mammoths (family *Elephantidae*) were Pleistocene animals. They lived mainly in cold regions of the Northern Hemisphere. (*See also* Elephant.)

BEGINNINGS *and Early* STRUGGLES *of* MANKIND

MAN. Scientists face extraordinary difficulties in their efforts to decide when and where the human race first appeared on the earth. The evidence they use is hard to find, and often it is just as hard to decide what the evidence means after it has been found. A tooth or a piece of skull may be dug out of an ancient bed of gravel alongside a river. It shows signs of having been rolled along the stream bed from some deposit upstream. If this is so, from what locality did it come and when was it deposited there?

EXAMPLES OF THE CAVE-MAN'S ART



These pictures were scratched on bits of ivory and bone by the artists of the Cro-Magnon period. They have a lifelike touch not found again in art until the Cretan and Grecian civilizations developed.

Similar puzzles arise in efforts to understand how men learned to use tools and live better than the animals around them. Undoubtedly men used sticks of wood and pieces of bone in early days, just as primitive peoples do today. But almost all such material has long since rotted away. Usually tools made of stone are all that are found. What can be judged from these alone about the lives of the men who made them?

In spite of these difficulties scientists are gradually piecing together an account of the earliest days of mankind. Some of their conclusions, and the evidence for them, are explained in a later section of the article. But this much seems unquestionably true: men were on the earth many thousands of years earlier than was formerly believed. Indeed, it is certain that the prehistoric period of man's existence was vastly longer than the period covered by recorded history. History, in the restricted sense of written records, began around 3100 B.C., when the art of writing seems first to have appeared. But many stone tools must be dated countless thousands of years earlier. And a long span of time must be added to allow for the days that must have passed before man learned to make such tools.

A CAVE-MAN'S MASTERPIECE

Some unknown Cro-Magnon, working in the dim firelight, engraved this delicate portrait of a giant stag on the ceiling of his cave dwelling.

Life of the Earliest Man

In the earliest days of the race, scientists feel sure, men wandered through tropical or semitropical lands, eating whatever food they could find. The climate had to be warm, because men who had no ability to make fires could not live through a severe winter without clothes. For food, they had what they could pick or capture with their bare hands. They might catch a small animal, a fish, or a bird, but usually they ate fruit, nuts, seeds, and roots.

Primitive men wore little or no clothing. Clothes were not needed in a warm climate. At night they found shelter in a tree or cave. Otherwise they were at the mercy of the huge beasts of prey.

Even before men could produce fire at will, they doubtless made use of it. They must have noticed that when the forest was set ablaze by lightning, even the strongest of animals were frightened away. *But this dreadful fire also provided* warmth on cool nights. Men may have collected some of the burning sticks to carry about and so learned to keep the flame alive.

Some savage undoubtedly noticed that by pounding rocks together he could make sparks, and the sparks would set fire to dry powdered wood. He who first started a fire by rubbing dry sticks made an even more useful discovery. No beast has ever learned how to make fire. With this invention, man made his first great step towards civilization. Fire gave him a weapon of defense, a source of comfort, and a means for cooking food.

At first men had no tools or weapons, except sticks and stones. They used these as they found them. Undoubtedly they learned to sharpen and harden the ends of sticks in fires. Thus they obtained a sort of rude spear. As soon as they began thinking about tools, they would notice useful properties in certain kinds of stones. For example, if a lump of flint is struck in the right way, it breaks like glass. Sharp-edged pieces could be used as knives. (A color picture of early men making such rude tools appears later in this article.)

Relics of this early period are few. But when men took refuge in caves and rock shelters, they unconsciously left records by leaving rubbish, bones of animals they ate, broken tools, and so on. Gradually dirt would cover the relics and help preserve them. As later generations used the same caves over a period of thousands of years, the record became deep and rich. In many caves, a crevice would open overhead, and a flow or drip of water would spread a deposit of limey stone over the entire rubbish heap. This would seal in and preserve everything. Cave deposits are among the most helpful sources there are for studying early man.

The Cro-Magnon Cave Men of Europe

Probably the most interesting cave dwellers in the record of mankind lived in Europe at the end of the Ice Age. Because the first remains of these cave dwellers were found at a spot called Cro-Magnon on the Vézère

ARTISTS OF CAVE-MAN DAYS AT WORK

These Cro-Magnon artists are busy placing pictures of animals on a cave wall. Helpers provide light with rude lamps made of hollowed-out stone, plant-fiber wicks, and melted animal fat. Earlier pictures were scratched in outline on the rock. Later the artists colored the pictures. The bottom picture shows colored animals made on a wall of the cave of Font-de-Gaume in France. Scholars think that the pictures were made for magic ceremonies, intended to bring good luck in hunting.

River in southern France. The men are called the Cro-Magnon race. The first skeleton discovered is known throughout the world as the "Old Man of Cro-Magnon." This old man was evidently one of the most intelligent men of his day. If he had had the advantages of modern education he might easily have been a scientist, a statesman, or a captain of industry.

But in those days, life was rugged. Indeed, the skull of a woman found near the old man has a hole in it, evidently made by a blow from a flint hatchet. But women in those days were hardy, like the men. Growth of the bone around the hole indicates that the woman recovered from this blow.

Such happenings were natural in the midst of the hard life the cave men led. They were surrounded by wild beasts, who threatened their lives every minute they were away from the shelter of their caves. While hunting the reindeer, the wild horse, and the bison, they were themselves hunted by the lion and the cave bear, who then inhabited Europe. They constantly ran a race for their lives with an angry mammoth, a woolly rhinoceros, or a pack of fierce wild boars.

Artists of Cro-Magnon Days

Yet these early men found time in the midst of their perils to draw excellent pictures, many of them very much better than most men can draw today. The walls of the old caves throughout France, Spain, and Italy are covered with finely carved and painted sketches of the animals the cave dwellers hunted. They carved the outlines of animals in the rock, then filled them in with colors made of brown, yellow, red, or black earth, mixed with oil.

Why did these cave-man artists work so patiently under such hard conditions? The customs of later primitive peoples suggest the answer. Probably they made the picture as part of a magic spell. When it was finished, magical ceremonies were performed with it to bring good luck in hunting.

But this does not explain everything. For magic spells, any scrawl or dummy object would be good enough. But these cave artists went to immense trouble to make their pictures *good*. Plainly they had strong artistic impulses as well as a desire to benefit from magic spells.

Another fact, and a grim one, speaks to us across thousands of years from these pictures. In a color picture on a later page, a cave-man artist is blowing red powder around his hand. This will leave a hard print outlined in red, as a sort of artist's signature. But close examination of the prints shows that many of the fin-

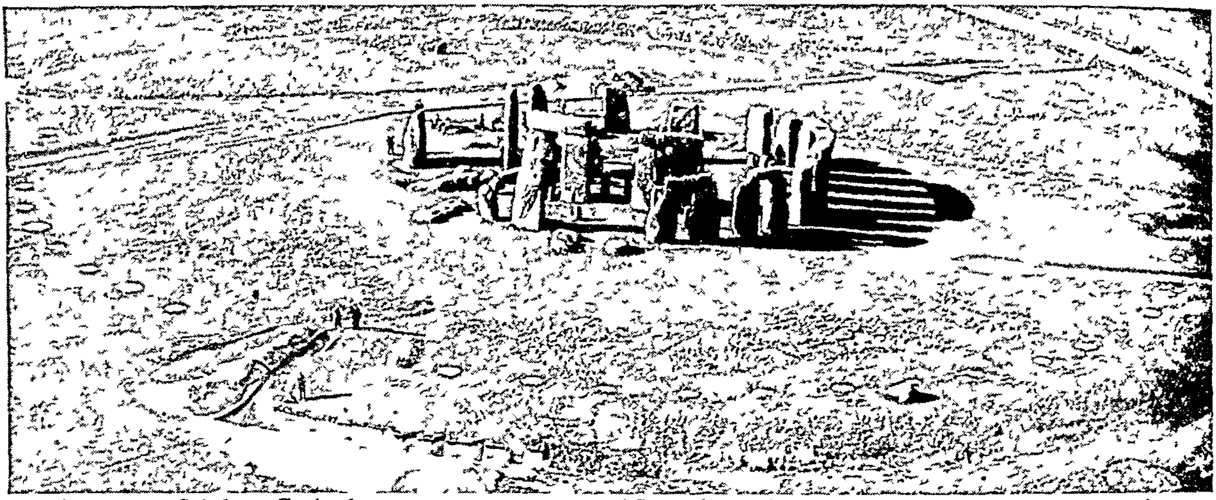
IN THE "WILD AND WOOLLY" DAYS OF LONG AGO

About the time our Cavemen ancestors were struggling to make both ends meet, the hairy Rhinoceros was roaming over the snow covered plains of Europe. A fierce and dangerous enemy he must have been with those two horns, the first one so long and sharp.

The great herds of Reindeer enjoyed the freezing climate which prevailed in those days, and the Cave Dwellers enjoyed the Reindeer, for these animals were their principal food. Occasionally, the hunters managed to trap and kill a Mammoth, and then everybody feasted.

The Cave Dwellers were followed by a people less artistic, but far more practical. These were the Neolithic tribes, who had tamed wild dogs, learned to make tents, and to polish the tips of their stone weapons. Here is a scene in one of their camps. All of these pictures are from murals by Charles R. Knight in the Hall of the Age of Man in the American Museum of Natural History.

MEN OF THE STONE AGE BUILT THIS TEMPLE



Stonehenge, near Salisbury, England, is an impressive example of Stone-Age architecture. The main structure consists of massive upright stones set in a circle 100 feet across and an inner horseshoe of even larger stones. Stonehenge probably served as a temple for worship and burial, but its arrangement suggests that priests also used it for observing the rising sun at the summer solstice.

gers have lost one or more joints. This may have happened while hunting or through other accidents; but similar mutilations found among many primitive peoples of historic times suggest another reason. The artist may have had to lop off a finger joint to prove himself worthy of working magic for the tribe with his pictures.

Growing Mastery over Nature

By the time these cave men were living in Europe, they had a well-developed social life. Skeletons grouped in burials tell us that they lived in families. Burials of implements and food with the dead suggest that they believed in a spirit world and made provision for it. Since the men hunted in groups, they must have lived in tribes.

Gradually the people developed better stone tools and new weapons. They learned to carve spearheads and harpoons from horn or bone. They also invented throwing sticks for weapons. With these they could hurl a spear farther and faster than they could by hand. For making these weapons and for carving fine figures of animals, they developed tiny, sharp blades of flint called *microliths*. The women learned to scrape and cure skins until they were soft and to sew them into garments with needles made of bone.

End of the Ice Age

People lived in this way in Europe while the last glaciers of the Ice Age melted. But long before the ice was gone, the climate of southwestern Asia and northern Africa had already turned dry and hot. The rich grass of Ice-Age times vanished and with it the grazing animals. Therefore men had to learn new ways of living.

Many of the African hunters crossed into Spain and then moved north. At this time, some of these people domesticated the dog for help in hunting. (A later page has a color picture of these hunters.) The bow and arrow also became common.

As the ice left Europe, forests covered the land and made hunting difficult. People found it easier to fish and dig shellfish. Many prehistoric fishing settlements have been found in Denmark. Along the seacoast, men built wattle huts by weaving reeds together and daubing them with clay. From their firesides they tossed away shells, bones, and useless articles. The rubbish gradually formed huge *kitchen middens*. They help tell us today how these people lived.

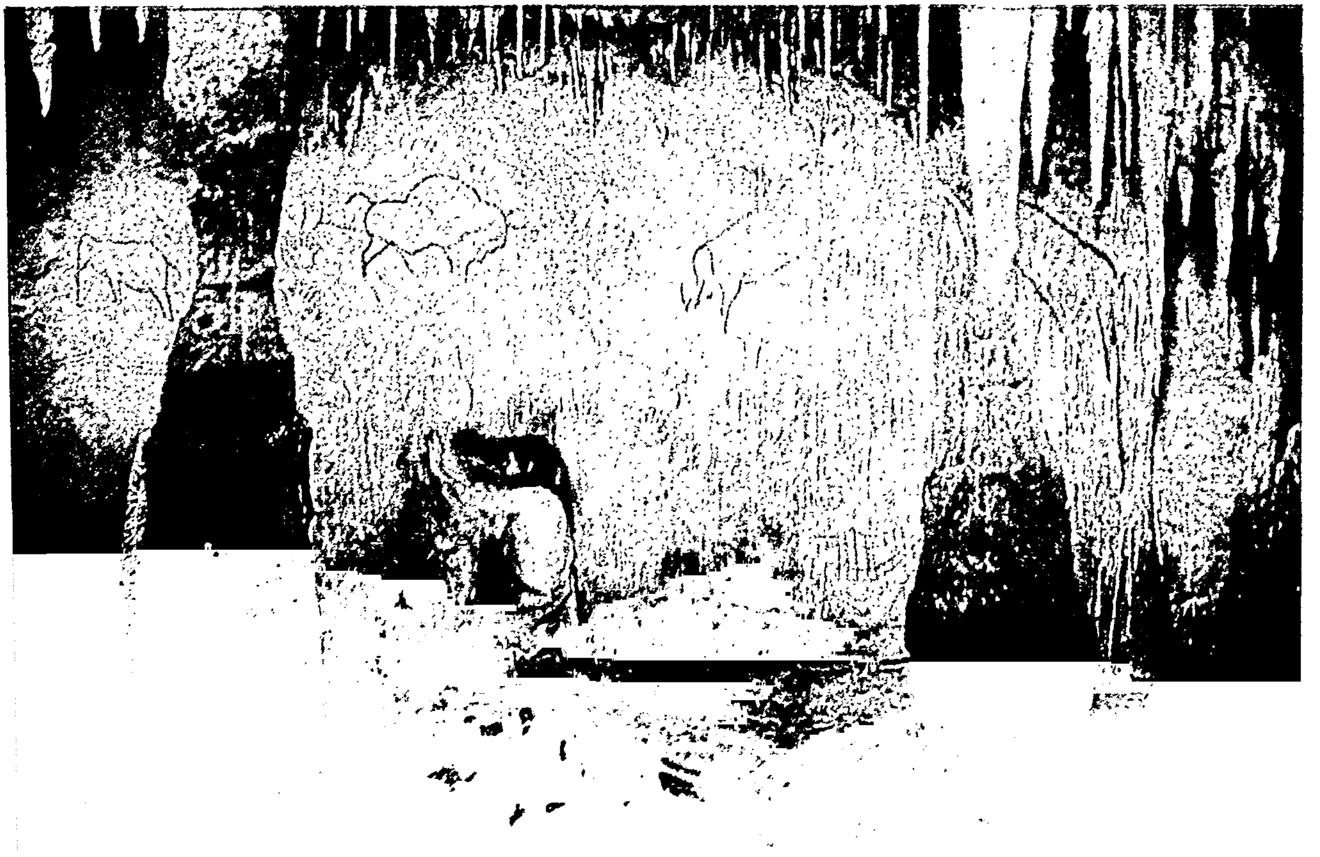
Other people developed the practise of arranging huge slabs of stone in long rows and wide circles to serve as temples. Stonehenge, which was one of the greatest structures of this type, still stands on the Salisbury plain in England.

Meanwhile the men who lived in the river valleys of Egypt, Mesopotamia, and India learned to grow food crops on the fertile land. Once agriculture had been invented, farming people settled down in villages and developed other useful arts. They learned to form and bake clay into pottery and thus obtained vessels for storage and cooking. They learned to plait rushes into baskets. They twisted animal hair or vegetable fiber into thread and wove the thread into cloth. They learned to polish stone and to make axes sharp enough to cut down trees and hew out lumber. Finally, they learned to smelt metal for tools.

These inventions laid the foundations for civilized living (*see* Civilization). People from the East brought them to Europe, following the Danube northward and westward. Thus this movement is called *Danubian*. Immigrants merged with the older inhabitants.

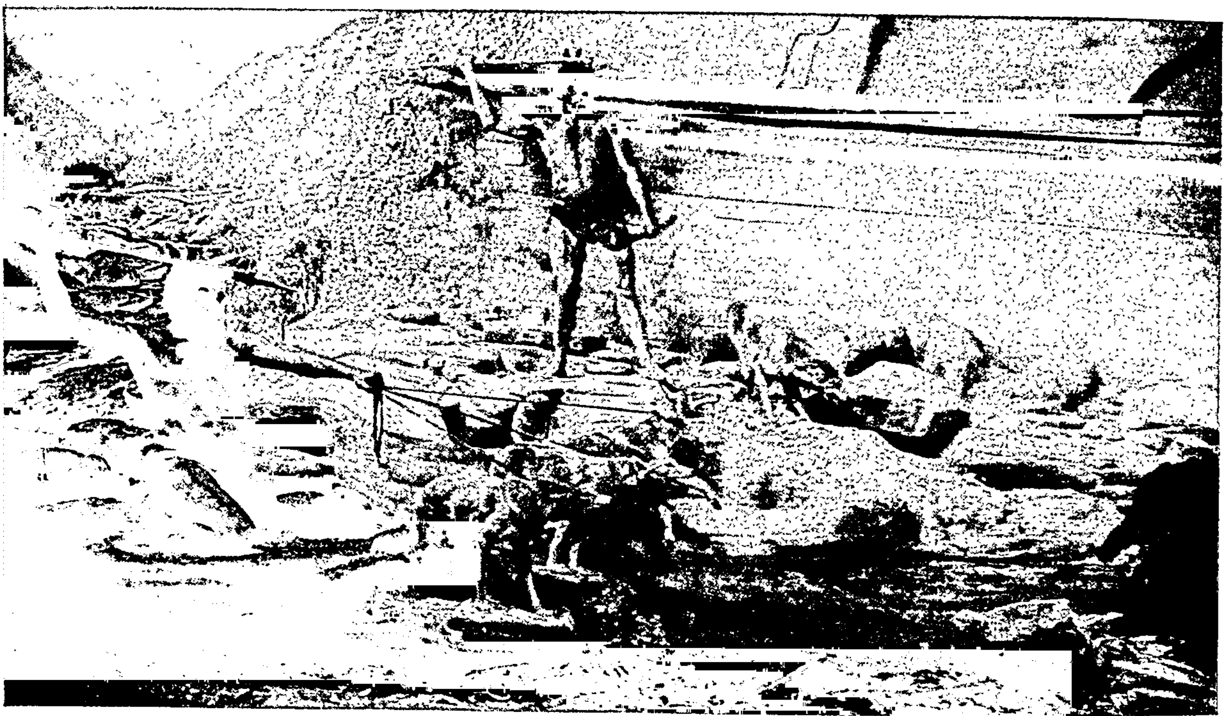
One of the curious developments of this time was the growth of lake dwellings in Switzerland, northern Italy, and elsewhere. To make themselves safe from attack, the people drove wooden piles into a lake bottom and built comfortable dwellings over them. At Wangen, Switzerland, no fewer than 50,000 piles tell of the great settlements which once stood there.

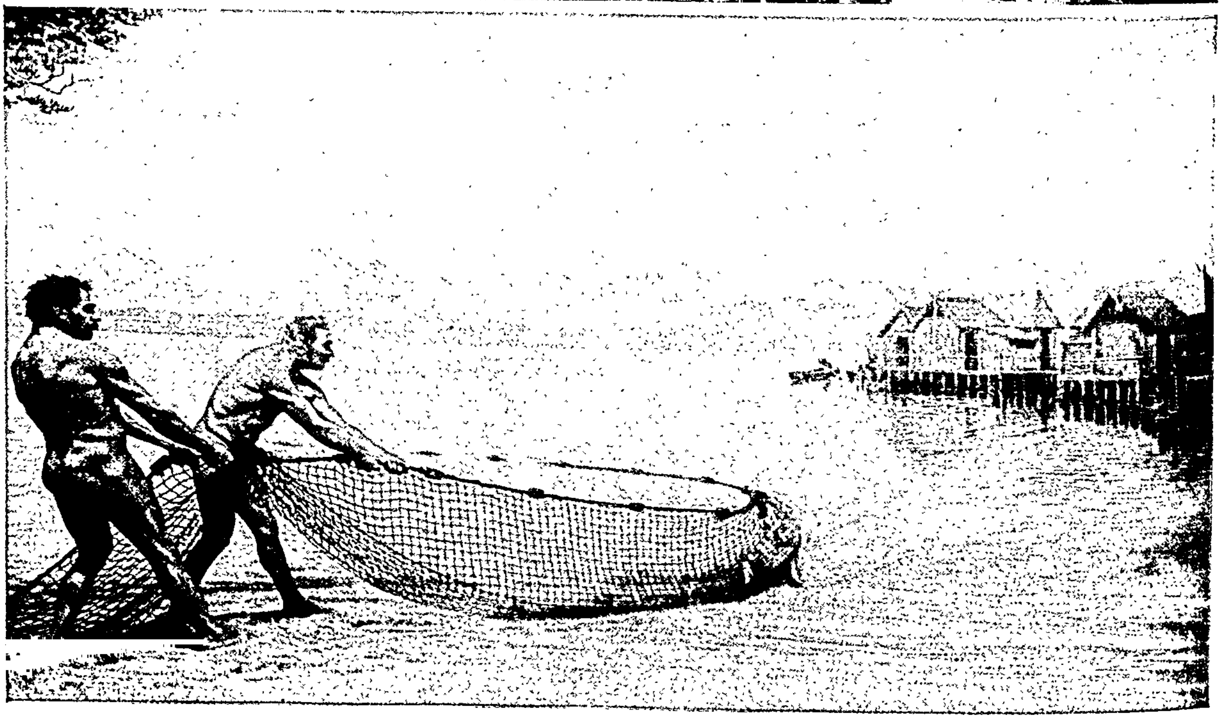
The people fished in the lakes, as shown in a color picture on a later page. On the shore near by they grew barley, wheat, millet, and flax, and kept domesticated sheep, goats, and cattle.



THE "DAWN MEN" AND THE CAVE DWELLERS

The upper picture shows people who lived along the Marne River in France about 250,000 years ago, according to scientists. They are called Chelleans. Another name is "dawn men." They could make fire, and chip stone into rough axes and scraping tools. Probably they slept beside rocks and trees. Below them is a cave dweller of Aurignacian times, about 35,000 years ago. These men drew pictures of animals on the walls of caves, and made prints of their hands by blowing red powder around them. The pictures are from exhibits in the Chicago Natural History Museum.





THE TAMERS OF ANIMALS AND THE LAKE DWELLERS

These pictures show two ages of progress after the cave dwellers shown on the preceding page. The people at the top were Azilians. They are named from relics of their culture found at Mas d'Azil, near the Pyrenees in southern France. They lived about 8,000 years ago, at the end of the Old Stone Age. By this time they had begun to tame animals and put them to work. The picture shows two Azilian hunters, armed with flint-tipped spears and clubs. They have cornered a wild boar with help from their dogs and are about to kill it.

The lake dwellers in the lower picture lived in Switzerland during the New Stone Age. They fished from shore with nets of linen cord, and from dugout canoes with spears and hooks. Their houses were set on wooden piles driven into lake bottoms. Small rail bridges linked the houses to each other and to the shore. These dwellings were one-room structures, with thatched roofs and walls of woven twigs or rushes plastered with clay. Fires burned in open stone hearths. These pictures are of exhibits in the Chicago Natural History Museum.

Meanwhile another important way of life developed on the semiarid grasslands, particularly in central Asia and Arabia. In these regions, people depended upon domesticated animals for food. But they had to move about, seeking fresh grass as the seasons changed. In central Asia, the people used horses and wandered freely over the huge region with their herds.

Such wandering peoples are called *nomads*. They were hardy and warlike, and often they raided the richer farming people, or even conquered them. Many of the great changes in history, occurred for this reason. Among them was the spread of Indo-European nomads from India to England and Spain.

How Scientists Study Early Man

SCIENTISTS who study the ancient *objects* of prehistoric times are called archeologists. Those who study the *lives of men* are called anthropologists. They are aided by the geologist, who helps determine the age of relics by examining the earth and the rocks. Fossil bones of animals are identified by the paleontologist. A highly skilled anatomist is needed to study human remains. (*See also* Archeology.)

The real study of early man began in 1846 in France. In that year Boucher de Perthes, a minor government official and antiquarian, announced discovery of ancient flint implements in gravel near Abbeville. With them were bones of elephants, rhinoceroses, and other animals no longer found in France.

For many years his discovery was scorned and discredited. But in 1859 Sir Joseph Prestwich, an English geologist, visited Abbeville to examine the evidence. He was convinced that de Perthes' find was genuine. From this time on, scientists began to realize that man had been on the earth much longer than anyone had formerly thought.

The Various Stone Ages

Later studies traced both the tools and lives of prehistoric men, and the record of man himself as a physical creature. Steps in tool making came to be called "stone ages" because stone tools were the most common find. Also, they were excellent clues to ways of living and level of mental development.

The first crude tools were simply conveniently shaped pieces of stone which showed the effects of use. Such a man-made object is called an *artifact*. These oldest tools are called *eoliths* ("dawn stones"). They are difficult to identify, because stream erosion or pressure from overlying rock can make about the same marks.

The oldest authentic human implements are called *paleoliths* ("old stones"). The men who made them belonged to the Paleolithic (old stone) Age. The earlier paleoliths were crudely shaped from flint or quartzite by striking off pieces with a hammer stone. Later men learned to strike off well-shaped chips or long blades, and chip ("retouch") them on the edges to exactly the shape desired.

Late in the Old Stone Age, men learned to make beautifully shaped tools by pressure flaking—that is, pressing off tiny chips with a bone or small stone. They also carved spearheads, harpoons, needles, and other tools from bone, ivory, or horn with tiny stone chips (*microliths*). The duration of the Old Stone Age is commonly estimated at several hundred thousand years.

The Mesolithic Age is a period of transition between the Old and New Stone (Neolithic) ages. The Neolithic Age was marked by stone axes, hoes, and other implements which were polished to a fine shape and edge by grinding. With them men could prepare timber for houses, cultivate fields, and pursue other activities of civilized living. In Egypt and Mesopotamia, man entered the New Stone Age about 8,000 years ago. In western Europe the Old Stone Age lasted much longer. Most Indians of America, when discovered by Europeans, were still in the New Stone Age stage of development. (*See also* Stone Age.)

After the Stone Ages came the Age of Metal. Copper implements and ornaments were apparently the first metal objects to be made. The Age of Copper began in Egypt about 5,000 years ago. This was followed some 1,500 years later by the Age of Bronze. Iron came into use in Europe during the thousand years before the beginning of the Christian Era. These metals made a new epoch in the life of humanity, for they gave man new power over the forces of nature. (*See also* Bronze; Civilization.)

Early Relatives of Modern Man

The study of man's record as a physical creature began with the discovery of skeletons which seemed manlike, but not like men as we know them today. These creatures came to be called the Neanderthal race because the remains of the first recognized member were found in 1856 in a cave in the valley of Neanderthal near Düsseldorf, Germany. Other remains of the same type have since been found in Europe.

The Neanderthal race is supposed to have lived somewhere between 50,000 and 100,000 years ago. Its members had heavy eyebrows like an ape's and no pronounced chin. The structure of the leg bones and spine did not permit them to stand upright. But this brutish appearance was belied by their intelligence. They made good stone weapons, lived in rock shelters, used fire, and hunted small game. They apparently buried their dead with some care. The "Rhodesian man," whose skull and bones were discovered in southern Africa, is believed to be a Neanderthal type.

About a third of a century later, a still more sensational discovery was made. In 1891 and 1892 Dr. Eugene Dubois found the top of a skull, three molar teeth, and a thigh bone scattered in a gravel bed near Trinil in Java. The thigh bone showed that the creature had walked erect; but the skull was massive and primitive. From these features, Dr. Dubois named the supposed creature *Pithecanthropus erectus*. The word Pithecanthropus is from the Greek *pithekos*, meaning "ape," and *anthropos*, meaning "man." The discovery was announced in 1894.

Still another relic of a primitive manlike creature is a lower jaw found near Heidelberg, Germany, in 1907. From it the whole skull has been reconstructed

by the methods of comparative anatomy. The jaw is massive and entirely lacks the chin projection. Some scientists estimate the age of the "Heidelberg man" at about 200,000 years.

The Coming of True Men

The Neanderthal race seems to have been exterminated by the Cro-Magnons, the famous cave dwellers of France. The first clear evidence of them was discovered in 1868. Whereas the earlier types are often classed as separate species of mankind (*Homo heidelbergensis*, *Homo neanderthalensis*, etc.), the Cro-Magnons were recognized as belonging to the same species (*Homo sapiens*) as modern men.

In 1906 skeletons of another type of modern man, called the Grimaldi race, were found on the Riviera. They were apparently a people of the Negro type.

During the period of these discoveries, most scientists believed in the Darwinian theory that higher forms evolved gradually from lower ones. Therefore they assumed that true man must have evolved from one or another of the lower forms which had been discovered; and they overlooked or denied the validity of several finds which did not fit into this view. One was a jawbone of modern human type, supposedly found in 1867 at Foxhall, England, in surroundings which suggested early Ice Age time. Another was a quite modern skull and jawbone found at Galley Hill near London in 1888.

The so-called Piltdown man, discovered by Charles Dawson in England in 1911, was exposed as a hoax in 1953. Tests for fluorine content showed that while the human skull was some 50,000 years old, the jawbone was that of a modern ape chemically treated to give it an aged appearance.

South African Primitives

New discoveries were made in South Africa after World War I. In 1924 the bones of a creature, called *Australopithecus*, were found. The skull (and therefore the brain) was barely above that of an ape in development. In 1936 Dr. Robert Broom found a skull at Sterkfontein which he named *Plesianthropus transvaalensis*. It was said to be more human than apelike, hence scientists consider it a "missing link."

In 1953 an expedition from the University of Capetown found fossilized human bones of Neanderthal type in the Cape of Good Hope region. The pieced-together skull was called Saldanha man.

Peking Man and Other Asian Primitives

Deposits believed to be 500,000 to 1,000,000 years old were discovered in China in 1929 and afterward in caves near Peking. The scientific name for Peking man is *Sinanthropus pekinensis*.

The discoverer of the site was Dr. J. G. Andersson, a geologist from Sweden. The man who found the remains was the director of the excavations, W. C. Pei, a member of the Geological Survey of China. The scientist who studied the remains was Prof. Davidson Black, a Canadian anatomist. The archeologist who co-operated in the work was Père Teilhard de Chardin, a Catholic priest and president of the Geological Society of France.

Besides yielding a perfect brain case, the excavations brought to light human teeth, jawbones, and numerous skull fragments from several individuals. The remains of cave bears, giant beavers, and primitive deer revealed the geological age. These men lived in the earlier part of the Ice Age (Pleistocene).

The bones of the skull were much thicker than the bones in modern skulls. The space for a brain was just large enough to rank as human. The forehead sloped back, somewhat like an ape's, and it had enormous eyebrow ridges. The jaw was massive, and it had no projecting chin. But the teeth were shaped like those of modern man. In later years many man-made objects (artifacts) were found. Other remains indicated the use of fire.

Peking man seemed almost like the Pithecanthropus type of Java. Before many years, more Pithecanthropus remains were found and still older, more primitive remains found in China and Java were brought to the United States in 1946 by Dr. G. H. R. von Koenigswald. One creature, *Pithecanthropus robustus*, was more apelike and larger than the "erect ape man" found by Dr. Dubois. A lone, huge molar suggested the existence of a giant early man (*Gigantopithecus*) more than ten feet tall.

The Mount Carmel and Charente Finds

Much was learned from extensive excavations made from 1929 through 1934 in caves at the western foot of the Mount Carmel range in Palestine. Here Miss Dorothy Garrod and coworkers pieced together from finds in several caves, a complete sequence of relics which they believe extends back 100,000 years, to a time before the last glaciation of the Ice Age.

In the lower depths of this sequence, many skeletons of Neanderthal type were discovered. But they had better developed foreheads and chins than did the Neanderthal race of Europe. In many respects they came close to matching the Cro-Magnons of Europe.

In 1935, however, the antiquity of the *sapiens* strain was supported by discovery at Swanscombe, England, of the top of a skull which seemed virtually modern. The geologic dating was second interglacial time, or much earlier than that of Mount Carmel.

In 1947 more evidence was found in the cave of Fontéchevade, near Montbrun in the department of Charente in France. There Miss Germaine Henri-Martin dug through a sheet of unbroken stalagmite and below it found the upper part of a skull and a fragment from the top of the nose and adjoining eye socket. Both were modern in structure; yet the surrounding animal bones were from the third interglacial.

This so-called "Charente man" seemed to provide a convincing link between modern man and the older skulls of modern type. Still more early remains of the modern type were found in 1951 in the Hotu cave in northern Iran (Persia) by Carleton Coon and Louis Dupree. Such evidence argues against relation to creatures of the Neanderthal type and suggests an origin far back in the Ice Age. However, none of the evidence shows how the strain originated or helps greatly in determining the place of origin.

Most students are inclined to believe that modern man originated in central or southern Asia, although Africa is a possibility. Such views rest upon studying the distribution of human relics around the world and then trying to decide where the first center must have been to account for the distribution. Failure to find undoubted remains of Old Stone Age culture in America means that the earliest humans of this continent came from Asia. Only the time of arrival is subject to question (*see* Folsom Man).

MAN, ISLE OF. In the Irish Sea, midway between England and Ireland, lies the Isle of Man, famed for its tailless Manx cats and as the scene of Hall Caine's Manx novels. On its hills and glens are many relics of prehistoric, Celtic, and Norse times. It is part of the United Kingdom, but retains partial home rule under one of the oldest parliaments in the world, the Tynwald Court. The lower house of this is called the House of Keys. More than half the area (221 square miles) is cultivated; oats and turnips are the chief crops. The capital and chief town is Douglas (population, 20,288). Holiday visitors, who come to enjoy the mild climate, are the chief source of income. Population (1951 census, preliminary), 55,213.

MAN'ATEE. The "sea cow," as the manatee is sometimes called, is a slow-moving, seal-shaped mammal that lives in shallow salt water, coming to the surface to breathe. Three species are known. One lives on the west coast of tropical Africa, one on the eastern coast of South America, and the third from Yucatan to Florida; it is now rare on the Florida coast. The manatee is 8 to 10 feet long, black, thick-skinned, and almost hairless, with a broad, shovel-like tail. It has only one pair of limbs—its front flippers. It uses these to push seaweed and other water plants toward its mouth, where the lobed upper lip clutches the food. The mothers guard their single young with great care.

Manatees belong to the order *Sirenia*, which also includes the dugong of the Indian Ocean, the Red Sea, and the Australian coast. Scientific name of the North American manatee, *Trichechus latirostris;* South American, *T. inunguis;* African, *T. senegalensis;* dugong, *Halicore dugong.*

MANCHESTER, ENGLAND. The city of Manchester, 31 miles east of Liverpool, is the cotton metropolis of the world. It is the hub of the smoky, densely populated, manufacturing district of Lancashire.

The 35-mile Manchester Ship Canal, which connects Manchester with the estuary of the Mersey River, has made it one of England's leading seaports. Not only textiles, but glass, clothing, machinery, railway cars, chemicals, dyes, rubber goods, and other products of an extensive industrial region are exported; and raw cotton, oil, fruit, grain, timber, and other commodities are shipped in from abroad.

The city's leadership in the textile industry can be traced back to the 12th century, when wool farming was established in Lancashire on a large scale. After the introduction of machinery for cotton spinning and weaving in the 18th century, this district naturally became the center of the cotton industry because the rivers furnished power and the damp climate was favorable to cotton spinning. When steam power came in, it had vast coal fields to draw on. With the building of railways, the position of Manchester was threatened, because railway charges and high dock dues ate up the profits. The city therefore made itself a seaport by building its ship canal, 1887–94.

Manchester has a university, several colleges and libraries, and a cathedral. The city and its suburbs were heavily bombed in the second World War. Population (1951 census, preliminary), 703,175.

MODERN MANCHURIA *and Its* VAST WEALTH

Extent.—North to south, about 1,800 miles; west to east, 900 miles Area, more than 400,000 sq. mi.; population, (1947 est.), 36,903,000

Physical Features.—The Manchurian Plain, 137,000 square miles. Mountains: Great Khingans, greatest elevation about 8,000 feet; Little Khingans; Chang Pai Shan, greatest elevation about 8,000 feet; Tienpao Shan. Rivers: Amur (called by the Chinese the Heilung Kiang or Black Dragon River), with its tributaries the Argun and the Ussuri, about 1,500 miles, forming the boundary with Siberia; other rivers, the Sungari, Nonni, Liao, Yalu, and Tumen.

Products.—Soy and other beans, kaoliang, millet, peanuts, wheat, corn, rice, hemp, cotton, jute, tobacco; timber, wild tussur silk; furs, hides, bristles; coal, iron, salt, soda, shale oil, petroleum, gold, lead, copper, manganese; bean cake, bean oil, flour, pig iron, wood pulp, glass, cement, paper, soap, leather.

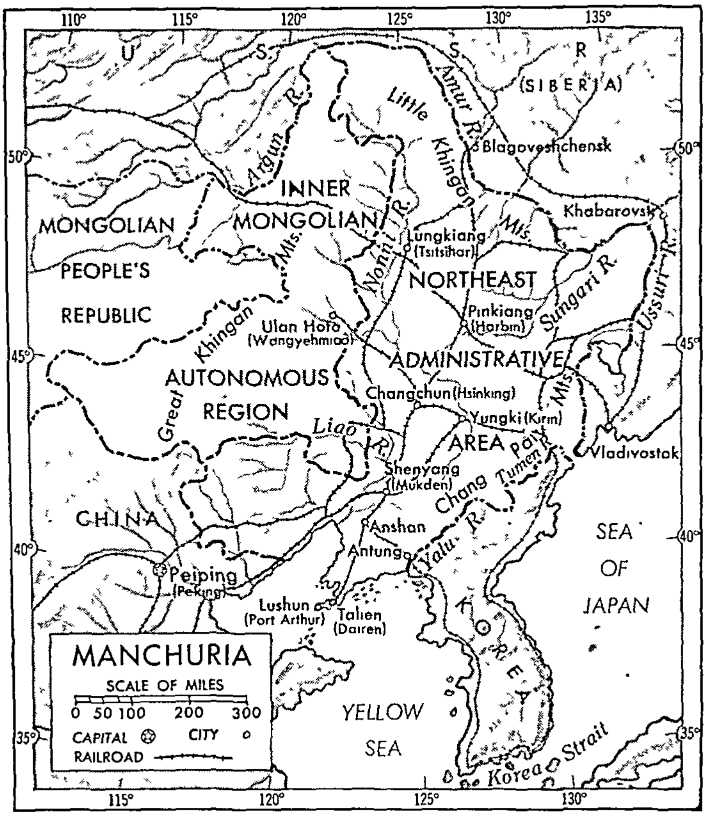
Principal Cities (1947 est.).—Shenyang (Mukden), 1,112,918; Pinkiang (Harbin), Changchun, Talien (Dairen)—over 500,000; Fushun, Antung, Yungki (Kirin), Mutankiang, Lungkiang (Tsitsihar), Kiamusze (Chiamussu), Anshan, Yingkow—over 150,000.

MANCHURIA. (*măn-chụr'ĭ-ạ*). The fertile plains and wooded mountains of Manchuria have passed into the possession of one nation after another. In 1931–32 Manchuria was seized from China by Japan. The Japanese then incorporated Manchuria into the puppet state of Manchukuo. For 13 years Japan exploited Manchuria's resources and developed new industries to supply the Japanese military power. Late in the second World War Russia seized Manchuria from Japan, then signed a treaty with Nationalist China, returning Manchuria to China. Yet Russia insisted on keeping certain rights in the rich region and was supported by the Chinese Communists. By 1949 the Chinese Communists had seized full control from Nationalist China.

The map shows why Manchuria has been sought by these powers. Japan looked to Manchuria's forests, farms, and mines to balance Japanese poverty in raw materials and farming land. Russia, north of the Argun and Amur rivers, wanted easier access to the ice-free ports in the south. The Chinese have wanted it as an outlet for the masses who throng China. The Chinese also sorely need Manchuria's industries and minerals.

Manchuria is separated from Siberia by the Amur River and two of its tributaries, the Argun and the Ussuri. The Tumen and Yalu rivers divide it from Korea. Its southern coast fronts on a great gulf that opens into the Yellow Sea. The line between Manchuria and Inner Mongolia is roughly defined by the Khingan Mountains. Though it has not been accurately measured, Manchuria is about 400,000 square miles in extent, or larger than Iowa, North and South Dakota, Nebraska, and Minnesota put together.

MANCHURIA'S MOUNTAIN-GIRT PLAIN



Manchuria has borne various names in its long history. As part of Communist China it is the Northeast Administrative Area. The Chinese have officially restored the Chinese city names, but some cities are better known by another name, shown here in parentheses. Notice that Manchuria's railways link it with China and Russia.

After China came under Communist rule, Manchuria became the Northeast Administrative Area of the Chinese People's Republic. It contains six provinces: Liaotung, Liaosi, Jehol, Kirin, Sungkiang, and Heilungkiang. The western part of Manchuria was incorporated in a new Inner Mongolian Autonomous Region. It contains the Manchurian province of Hsingan and territory once part of historic Inner Mongolia (*see* Mongolia).

Fertile Plains and Wooded Mountains

The great central plain in the heart of the country is like the northern Middle West of North America in a number of ways. It is a rolling, grassy prairie, surrounded by mountains. Its winter is bitterly cold and its summer hot; and rainfall is usually sufficient for crops except in its dry western portion. It was rapidly populated by mass migration of peoples seeking good farm land.

Many muddy rivers drain the plain. The great Nonni flows down from the north to join the greater Sungari, which flows northeast through the mountain gates into the Amur. In the south the chief river is the Liao, which empties into the Gulf of Liaotung. All the rivers in the country freeze over for several months in the winter and then they may be used as roads. Downstream stretches of the rivers are navigable. Manchurian rivers are widely used to float great rafts of timber down from the forests.

Uplands border the plain. The southern, eastern, and northern mountains are generally forested. Though the more accessible slopes have been stripped of trees, great wealth in pine, larch, fir, spruce, oak, elm, birch, maple, walnut, and other timber remains. Forests also push out into the plain along the river courses. About 30 per cent of Manchuria is still forested.

Monsoon Winds Modify the Climate

The climate is in some respects unique. The wide range of temperatures from winter to summer is typical of large land areas inside a continent in the middle latitudes (*see* Climate). The prevailing winds, however, are the monsoons, which blow cold and dry from Siberia in winter and warm and moist from the southern and southeastern seas in summer (*see* Winds). The cold north winds bring little snow, and drought may threaten crops in spring. Abundant rains, occasionally flooding the river valleys, fall in summer during the growing season. More than half a year's rain may come in July and August. The north is drier than the south, and the far west tends to be too dry for any use except pasture. In the center, the annual rainfall amounts to about 24 inches; in the eastern mountains it may be as high as 40 inches; and in the far west as low as 4 inches.

Though the plain is less than 1,000 feet high and lies in the same latitudes as the northern United States and southern Canada, it has long, sub-Arctic winters. Frost may appear on as many as 225 days in the year in the north and on 180 days in the south. The brief, hot summers help make the plain one of the great granaries of the world, since most of its soil is dark and rich.

Manchuria's Mixed Population

The 36,903,000 inhabitants of Manchuria are mainly Chinese, Mongols, and Manchus. The Chinese are in the overwhelming majority, comprising about 90 per cent of the population. The Mongols, usually in the western part, add another 4 per cent. The Manchus are a small minority. From 2 to 3 per cent are Koreans, and there are lesser numbers of other nationalities. Russians have increased since the country became Communist. Russian engineers and technicians came in to operate industries and transportation lines, since the Chinese Communists faced a shortage of trained workers.

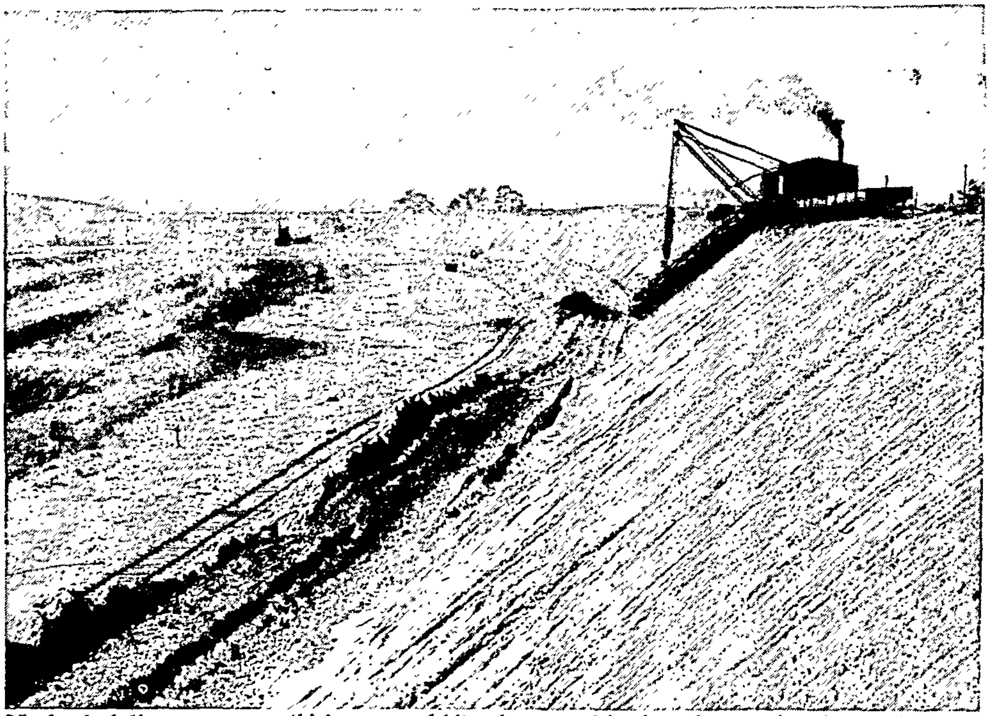
When the Japanese government ruled Manchuria, it tried to induce Japanese farmers to migrate here, but its efforts met with small success. The Japanese peasants did not like to leave home, and they hesitated to compete with the frugal Chinese and Korean farmers.

The Development of Agriculture

Nearly 90 per cent of the population is agricultural. Southern Manchuria is very densely populated, mainly with Chinese farmers, while

North Manchuria still has large undeveloped areas. In all Manchuria, it is estimated, half the arable land or more is still untouched by the plow.

THE WORLD'S LARGEST OPEN-CUT COAL MINES



Mechanical diggers uncover thick seams of bituminous coal in these huge strip mines at Fushun. This coal has been a most important factor in Manchuria's development.

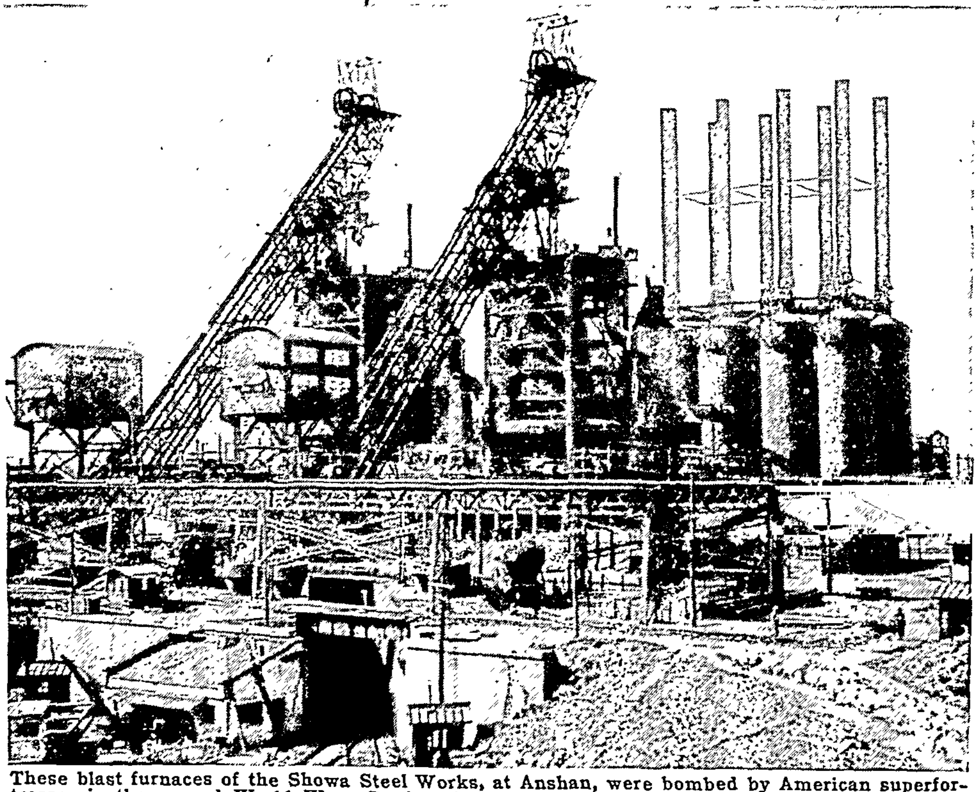
The land is well adapted to large-scale farming with machinery. Yet most of the farms are small, cultivated with primitive homemade wooden tools; and the farming population consists overwhelmingly of owners or tenants cultivating small farms and of hired laborers. Northward, the number of large holdings cultivated by hired labor increases.

The Chinese peasant farms much as he did in China. He keeps a few chickens and a pig for his own food and for fertilizer, and a horse or cow to drag his plow if he can afford it; if not, he has his field plowed on contract by a wealthier neighbor. Though too poor to keep many farm animals, such farmers altogether keep 8,000,000 swine.

The main cash crop is the soy bean, which rose to prominence after the Sino-Japanese War of 1894–95. The returning Japanese tried bean cake on their rice fields and found it a good substitute for the more costly fish fertilizer. Thus, an almost worthless by-product of bean oil immediately became of major importance; and Manchuria grew famous as the world's chief source of soy beans. New uses for the bean were found in industry and agriculture (*see* Soy Bean). Soy beans are still Manchuria's chief stock in world trade but the market is being narrowed as other countries begin to raise soy beans and lay high tariffs on imports.

Kaoliang, a giant sorghum, is the chief grain crop. The farmers use the pea-sized grains for their own food, feed them to stock, and make a fermented drink from them. With the stalks, they thatch the

STEEL WORKS BUILT IN MANCHURIA BY JAPAN



These blast furnaces of the Showa Steel Works, at Anshan, were bombed by American superfortresses in the second World War. During their control of Manchuria, the Japanese had made Anshan the second largest steel-producing center of their empire.

roofs of their mud huts, make fires, and feed the farm animals. Millet, grown largely in the north, is next to kaoliang in importance. Other crops include wheat, corn, rice, peanuts, cotton, hemp, jute, tobacco, and flax. Some of these are raised only on a small or experimental scale. North Manchuria is comparable to western Canada in fitness for wheat growing, but the wheat raised does not meet the large domestic needs.

Pastoral Life in the Mongolian Area

This is the agriculture of the Manchurian Plain. Very different is the pastoral life of the Mongol region of Hsingan in the west, which sits astride of the Great Khingans, with one foot in the Manchurian Plain and the other in the eastern end of the Mongolian Plain (*see* Mongolia). Here the Mongols live mainly by their flocks of sheep and goats and their herds of horses and cattle.

In western Jehol, also, nomadic Mongols drive their herds and flocks from pasture to pastuie. Jehol, in southwest Manchuria, was once part of Inner Mongolia, but Chinese settlers far outnumber the Mongols there today. They farm wherever the mountainous land and low rainfall peimit cultivation.

Hsingan and Jehol are the regions from which come Manchurian wool, horsehides, cowhides, sheepskins, lambskins, and goatskins; also furs, including sable, ermine, leopaid, lynx, marten, fitch, squiriel, fox, deer, and wolf.

Mineral Resources and Manufactures

The most valuable Manchurian mineral is coal, which is widely distributed, though much of it is poor in quality. At Fushun, however, east of Mukden, is a fairly good bituminous coal in the thickest seam in the world, averaging 150 feet and attaining a thickness of 417 feet. The total deposit is estimated to be about a billion tons. The coal is mined from the largest open cut in the world, and also in the usual way, with deep shafts and horizontal galleries. The Penhsihu mine not far away has a smaller output of a better coal. Nearly half the coal mined is used in Manchuria, mostly by the iron and steel and other industries, though the people are learning to use coal instead of kaoliang stalks for fuel. The coal seam is overlain by oil shale, from which oil is extracted at heavy cost. Petroleum deposits have also been found. Most of the iron ore deposits are in the region around Mukden. The most important mine, with huge deposits of low-grade ore, is at Anshan.

Other mineral resources include limestone, silica, salt, soda, lead, copper, aluminum, and molybdenum Alluvial gold is found in the valleys of the Amur, Sungari, Nonni, Yalu, and other rivers. The Japanese built extensive hydroelectric plants on the Yalu. They supply much of the power for the important heavy industries in the Mukden-Anshan area.

The most important Manchurian manufacture is based on Manchuria's largest natural product, the soybean. Primitive little bean-oil presses, worked by hand or by farm animals, still exist throughout the countryside, but more than half the bean oil and bean cake made in Manchuria is produced in the great hydraulic presses at Dairen.

Flour milling, centered at Harbin in the wheat district, and distilling and brewing are the next most important industries. Their products are consumed in the country, but the flour is not sufficient to meet home demands.

MANCHURIA'S MOST IMPORTANT GRAIN

The giant sorghum called kaoliang is the country's most important grain and ranks next to the soybean in value. This picture, by Julien Bryan, shows the resemblance between a field of kaoliang and corn. The peasant-type straw hat (left) contrasts oddly with the modern Panama hat.

Japan developed heavy industries in Manchuria, hoping to have an iron supply that could not be cut off by war. Chief of these were the great iron and steel works at Anshan and Penhsihu. They also set up chemical, aluminum, and synthetic oil and rubber factories as well as munitions plants. Though these works turned out millions of tons of iron and steel and other supplies, they did not reach the goal set by the Japanese. In the second World War these Japanese industiies in Manchuria were damaged by American bombing raids. At the end of the war Russia seized much of the remaining equipment. After the Chinese Communists got control of Manchuria in 1948 they at once began to rebuild the industries. They received some technical aid from engineers supplied by Russia.

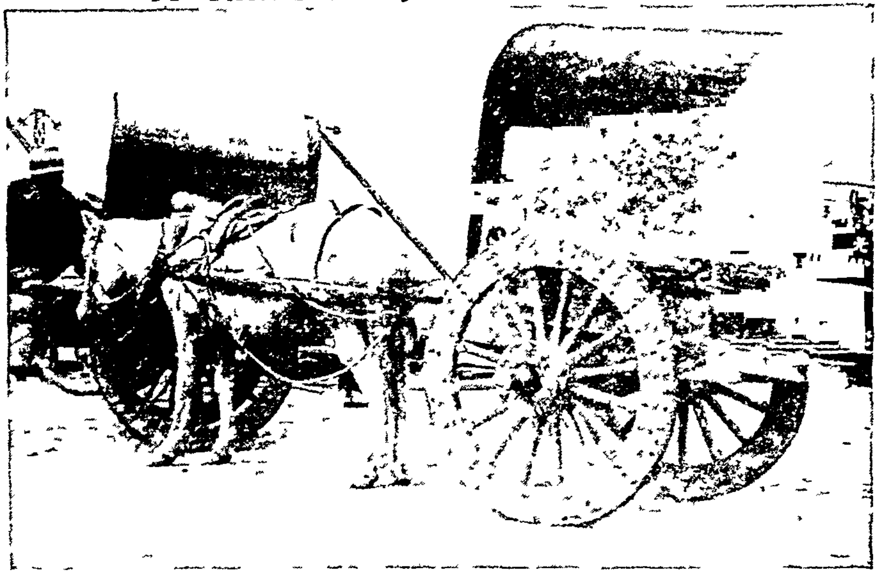
Foreign Trade and Cities

The principal exports are soybeans and other beans, bean cake, coal, millet, peanuts, and bean oil. Minor exports include bristles, hemp seed, furs, and skins. The principal imports are cotton

piece goods, wheat, flour, iron and steel, vehicles, machinery, and tools.

Most of Manchuria's foreign commerce passes through the port of Dairen which, though not entirely ice-free in winter, can be kept open by ice breakers. The ice-free harbor of Port Arthur was made a joint Chinese and Russian naval base by the 1945 treaty between these two powers. At Hulutao, which is ice-free, a new port was constructed by the Japanese. Antung, at the mouth of the Yalu, an important log-rafting river, is the largest shipping port for timber. Yingkow, the oldest Manchurian seaport, is the only other port worth mentioning on Manchuria's short coast.

IT TAKES THE JOY OUT OF TRAVEL



This is the famous springless cart which is used for transporting passengers in Manchuria and north China. Notice the narrow but heavy iron-studded tires, which cut through mud and dust to the solid ground below. These vehicles are so solidly built that they are almost indestructible; but they are not what we would call comfortable.

Of the cities, Mukden, once the political center of the plain, is the largest. Harbin, built by the Russians, has the greatest white population in Asia; and Changchun, which was called Hsinking by the Japanese, was the capital of their puppet state of Manchukuo. Tsitsihar, Hailar, and Manchouli, all on railway lines, are important Mongol centers.

Railways and Other Transportation

Manchuria is better served by railways than any other part of China. The Soviet-Chinese treaty of 1945 combined the main lines into the Chinese Changchun Railway, and provided that they should be owned and operated jointly by China and Russia. The main systems incorporated were the Chinese Eastern Railway, which crossed the country in a southeast direction from Manchouli on the Russian border to Suifenho on the eastern border near the Russian port of Vladivostok; and the South Manchuria Railway, which took a southwesterly course from Hailun in the north to Dairen and Port Arthur. Both lines were built by Russia, but the South Manchuria Railway had been controlled by the Japanese since their victorious war with Russia in 1904–05. A joint enterprise of the Japanese government and private capital, the railway was a little empire in itself. It controlled coal mines, oil shales, and steel works; ran hotels, hospitals, and schools; built harbors, operated motorbus lines, and conducted agricultural, geologic, and other scientific research.

Most of the wagon roads are scarcely more than rutted tracks, over which the peasants haul their beans and other produce to market in two-wheeled carts drawn by horses or mules. These roads are none too good, even at their best, when frozen in winter. During the summer rains they become impassable morasses for weeks at a time. Modern motor highways amount to over 3,500 miles. Air lines offer speedy service between the main cities of Manchuria and furnish connections with principal cities of the Far East. Telephone, telegraph, and radio systems connect all the centers of population.

History of Manchuria

Over the vast Manchurian Plain nomad tribes roamed for ages, every now and then invading China in spite of the Great Wall built to keep them out. One such people, the Manchus, akin to the Mongols but less stubbornly nomadic, in imitation of their civilized Chinese neighbors set up an emperor of their own at Mukden. In 1644 Chinese and Mongol allies helped place the Manchu emperor on the throne at Peking, where his successors remained until 1912 (*see* China).

Manchuria long remained thinly peopled, for the Manchu emperors used its fighting men to garrison China and forbade the Chinese to settle there. Yet the prohibition, once or twice relaxed, could not prevent the famine-driven people of North China from spilling over into the good Manchurian lands, until the population became mainly Chinese. In the 20th century Chinese immigration swelled to a flood. But more vigorous countries than China had their eyes fixed hungrily on this rich and undeveloped territory.

After a brief but decisive war with China (1894–95), Japan obtained, as part of the spoils, the key to Manchuria. This was the Liaotung Peninsula, which Germany, France, and Russia forbade Japan to keep. Russia later obtained the tip of the peninsula on lease, and Japan in 1905 won it back (*see* Russo-Japanese War).

When the Chinese Revolution swept the seven-year-old Manchu emperor from his throne in 1912 to become plain Mr. Henry Pu-yi, China continued to claim dominion over the three eastern provinces and Jehol, but the war lords put in as governors recognized China's authority only when they liked. Extortion, banditry, and debased currency marked their rule.

Meanwhile tensions and rivalries developed over the Manchurian railroads among China, Japan, and

Russia. In 1930 China was sole owner of nearly half the railroads in Manchuria, and joint owner with Russia of about two-thirds of the remainder. Japan owned a little more than one-sixth of the mileage, but that sixth included the strategically dominant and very profitable South Manchuria Railway. Moreover, more than half the Chinese roads had been built with Japanese loans, and the payments were now in default. China had tried to oust Russia from control of the Chinese Eastern Railway crossing Manchuria to Vladivostok, and was attempting to divert traffic from the South Manchuria Railway to the Chinese Eastern line.

LOADING OIL CAKE FOR EXPORT

Each coolie's load, which looks like automobile tires, really is oil cake, left after the soybean has been squeezed dry of oil in a hydraulic press. The cakes are going aboard a steamer in Dairen for export to Japan. There the cake is used in many ways, one of which is to fertilize the mulberry trees that furnish leaves for feeding silkworms.

Japanese Army Sets Up Puppet State

The situation was highly dangerous, but by the middle of 1931 the danger seemed almost averted. The governments of Japan and China were both pledged to a peaceful settlement of all their differences. On the eve of the conference to effect this settlement, a bomb went off on the tracks of the South Manchuria Railway—placed there, said the Japanese, by Chinese soldiers. It acted less like a bomb than like an electric push button, for it did little direct damage but instantly gave an excuse to the Japanese Kwantung army to occupy Mukden and other important cities all over Manchuria. The more conservative Japanese statesmen at home confessed that this move and those that followed were planned entirely by the army leaders who refused to recognize orders from Tokyo. Nevertheless, the Japanese government took all the profit it could from the adventure.

Early in 1932 the foundation of the new government of Manchukuo was announced. The Japanese army next year bestowed Jehol on it. In 1934 Japanese military authorities announced that Henry Pu-yi had consented to resume the throne of his ancestors as Emperor Kang-teh. The "paper constitution" issued in the name of the Emperor of Manchukuo recognized him as the source of all authority, but the Japanese army, stationed there to guard Kwantung Leased Territory and the railway zone, created Manchukuo and remained the source of all power in it.

Russo-Japanese Agreements, 1935-45

In 1935 Russia agreed to sell to Manchukuo its interest in the Chinese Eastern Railway, which the Japanese army had already seized for the new state. Japan guaranteed the payment. China's protests that the sale violated its rights went unheeded.

Occasional border clashes between Kwantung army troops and Soviet Far Eastern forces disturbed the relations between Russia and Japan during the 1930's. But the two countries adhered to the terms of their neutrality pact of April 13, 1941, until the final days of the second World War, and the powerful forces of both nations in this region remained inactive until Aug. 8, 1945. Then Russia, which had denounced the neutrality pact in April, declared war on Japan and invaded Manchuria (*see* World War, Second).

Land of the Manchus in War and "Peace"

Russian armies from Outer Mongolia and from the east cut the Japanese forces in two. But the Japanese continued to fight till Aug. 20, 1945, five days after the surrender of their homeland.

Even before the Japanese surrendered, Russia and the Nationalist government of China had signed a pact on Aug. 14, 1945, providing for joint rights in Manchuria. The treaty returned Manchuria to Nationalist China. The Chinese then designated Manchuria as the provinces of Liaoning, Kirin, and Heilungkiang. The treaty made Port Arthur a joint naval base of Russia and China. Dairen became a free port.

But the Chinese Communists were strong in Manchuria. They refused to withdraw until Nationalist China admitted them to a coalition government. In 1947 Nationalist armies attacked in Manchuria. The Communists had won Manchuria by 1949 and swept south to seize China proper. In 1950 Communist China and Russia signed a pact. Under it Russia announced the return of the Changchun Railway to China in 1953. After the Chinese Reds invaded Korea in 1950, the United Nations bombed Manchuria's military bases and hydroelectric installations. By 1954 they were largely repaired and industry was resumed. (For Reference-Outline and Bibliography, *see* China.)

MANDOLIN. This stringed instrument has a deep pear-shaped body, like that of the ancient lute, a sounding board, and a fretted neck. Its tinkling notes are produced by rapidly twanging the strings with a bone or metal plectrum, or pick. It is a favorite instrument for accompanying the voice, especially in Spain and Italy. The Neapolitan type, with four double strings, is most commonly used.

MANDRAKE. In past times people regarded this Old World herb with superstitious awe. Shakespeare and other old writers often refer to its narcotic powers. They also speak of it as shrieking when torn from the ground, because of the fanciful resemblance of its long forked root to the human figure. It was much used as a drug and in love philters.

The mandrake (*Mandragora officinarum*) is native to India and the Far East. It belongs to the poisonous nightshade family (*Solanaceae*). The mandrake of the United States is the may apple (*see* May Apple).

MANGANESE. Railroad switch points and frogs would soon be battered out of shape if they were not made of steel alloyed with manganese. This hard gray metal touched with red has the property of making iron and copper exceptionally tough and strong. (*See* Alloys; Iron and Steel.) In small proportions it is indispensable in making most steel because it removes oxygen and sulphur during the melting. Manganese bronze used for propellers has about 3½ per cent manganese.

Manganese is introduced into steel by adding an iron alloy, either *ferro-manganese* (about 80 per cent manganese) or *spiegeleisen* (about 20 per cent). These alloys are obtained by smelting iron ore with an ore which is rich in manganese.

The United States normally obtains manganese ore from Russia, the Indian Peninsula, the Gold Coast, Brazil, Cuba, the Union of South Africa, and Chile. Deposits in the United States are ample but are mostly low grade. On entering war in 1941, it turned to its own deposits and built plants for extracting manganese from low-grade ores. The metal can be separated by electrolysis from a solution containing ore. In another process, impurities are floated off when powdered ore is stirred in a suitable solution.

Manganese has various isotopes, with valences of 2, 3, 4, 6, and 7, and in each it has a different color. Pink, red, black, green, and purple compounds are common. The purple *permanganates* are important disinfecting agents, as in Condy's fluid (sodium permanganate) and potassium permanganate. The dioxide is used in paints, dyes, glassmaking, and as a depolarizer in dry cells. The chief ores are *pyrolusite*, *hausmannite*, and *manganese spar*. Manganese is probably an important element in plant growth. The atomic weight is 54.93; the atomic number is 25. The metal was first isolated in 1774.

MANGO. One of man's greatest triumphs in improving wild plants is the cultivated mango. In its home in India, this evergreen tree originally had a small plumlike fruit, with a turpentine flavor. Centuries of cultivation and selection have produced a luscious fruit somewhat like a small melon. Many varieties are now grown in Florida, the Caribbean region, and elsewhere in the tropics and subtropics. Green mangoes are used for pickles and preserves, and so the name has come to be applied also to pickles and preserves made from melons, peppers, and cucumbers.

The tree grows from 40 to 90 feet high. Its large glossy leaves make it a beautiful shade tree. In Florida the pinkish-white flowers bloom from December to April. The mango (*Mangifera indica*) belongs to the cashew family or *Anacardiaceæ*.

MANGROVE. Most trees cannot live on tide-drenched seashores. Their roots cannot get air from the wet soil. But one tree in tropical and subtropical lands does so very well. The mangrove gets air by dropping vinelike roots from its trunk and branches to the surrounding mud. These aerial roots take in air through their pores at every low tide. Seeds do not break away from the tree until they have sent down a root to win a foothold in the mud.

These trees grow thickly on tidal flats in Florida and on other warm, flat seacoasts. The tangled roots catch mud, and thus help to build new land. The tree grows 30 to 40 feet high. The bark and leaves are rich in tannin. Bark and tannin extract are exported by Central and South America for tanning hides. Scientific name, *Rhizophora mangle*.

MANILA. PHILIPPINE ISLANDS. A fine natural harbor and the rich surrounding country have combined to make Manila the chief city of the Philippines. It lies on the west central coast of the island of Luzon, on a narrow shelf of low land along the eastern shore of Manila Bay. It flanks both sides of the mouth of the Pasig River.

The site of Manila was a tiny fishing village when the Spaniards took it in 1571. By the early 17th century they had made it one of the chief centers of culture and commerce in the Far East. On the south bank of the Pasig they built Intramuros, the walled city, with its convents and churches. Here in 1611 Dominican friars founded Santo Tomás University.

As Spain's power waned, Manila lost its leadership in world trade, and became relatively unimportant until after the Spanish-American War. Following the American occupation of the Philippines a thriving new city grew north of the Pasig, with modern offices and industrial plants. Here were established the leading manufacturing industries of cotton textiles, tobacco products, manila rope, coconut oil and liquor. The city also became a large shipbuilding center. Beyond the business district huddled the thatched huts of Tondo, the crowded Filipino settlement, and still further out, handsome residences and apartments were built. The headquarters of the University of the Philippines was established in Manila in 1908.

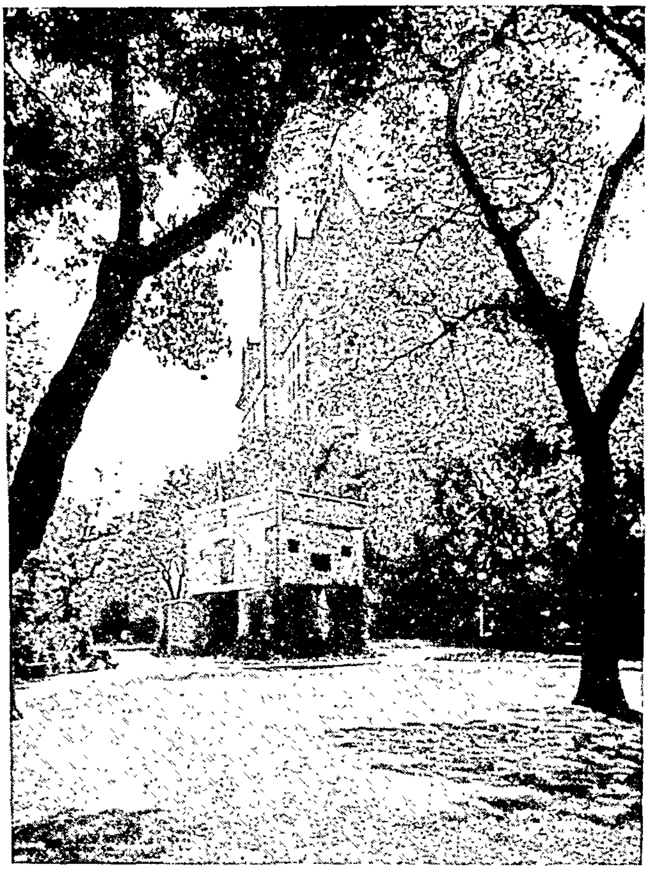
A naval base was built at Cavite, about 7½ miles southwest of the city, and the small islands of Corregidor and Cavallo at the mouth of Manila Bay were heavily fortified.

The Japanese captured Manila on Jan. 2, 1942, during the second World War, and occupied it for three years. Before this, the population had increased to more than a million, as thousands of people from the provinces crowded into the city when the attack started. The American forces returned to recapture the city Feb. 23, 1945. When the encircled Japanese troops foresaw defeat, they burned and killed as they retreated. In Intramuros thousands of Filipino civilians were killed and virtually every large building there was demolished. (*See also* Philippine Islands.) Population (1948 census), 983,906.

MANITOBA—*Where* EAST *Meets* WEST *in* CANADA

MANITOBA. The easternmost of the three "Prairie Provinces" of Canada lies almost exactly in the center of the continent between the Atlantic and Pacific oceans, the Gulf of Mexico, and the Arctic Ocean. Yet this inland province has a 440-mile seacoast on Hudson Bay.

The "Keystone Province," as it also calls itself, is a link between the agricultural west and the industrial east. Through the great railroad center of Winnipeg, the capital city, the grains and other food products of the prairies flow to the export markets of the east, and the manufactured products of Ontario and Quebec move to the prairie farms and villages.



This gate is all that remains of Upper Fort Garry, built by the Hudson's Bay Company in 1821. Around it grew the modern city of Winnipeg. It stands on the grounds of the Fort Garry Hotel.

Manitoba's area of 246,512 square miles is twice as large as the British Isles and larger than the combined areas of Minnesota, Wisconsin, Illinois, and Iowa. The population, according to the 1951 census, is 776,541. This is an average density of 3.5 to the square mile. But Manitoba is remarkable for the concentration of its people in one urban district. One third of the population lives in Winnipeg and in St. Boniface, across the Red River from Winnipeg.

The nature of the land explains why so many people live in such a small area. Although Manitoba is known as a prairie province, actually three fourths of it is lake, forest, treeless tundra, and rock. A strip of Arctic plain about a hundred miles wide borders Hudson Bay. Most of the remaining area lies within the Laurentian Plateau, a rocky upland, about 1,000 feet above sea level, covered with vast forests and many interweaving lakes and rivers (*see* Laurentian Plateau).

Southern Prairies

The fertile prairies extend in a narrow band across the southern part of the province only as far north as the lakes. South of Winnipeg the valley of the Red River of the North is a flat plain of rich, black soil, covered in summer for hundreds of square miles with fields of golden wheat. This plain was once the bed of preglacial Lake Agassiz. Its remnants today are Lake Winnipeg, the largest lake in the province (9,094 square miles in area), Lake Winnipegosis (2,086 square miles), and Lake Manitoba (1,817 square miles).

The western shore of the ancient lake bed is marked by a steep escarpment. It runs from southeast to northwest, as far as the Saskatchewan River. The escarpment includes the forested Pembina Hills, Riding Mountain, Duck Mountain, and Porcupine Mountain.

West of the escarpment the prairies continue into Saskatchewan. This western prairie is higher and more rolling than the Red River plain. All the rivers of Manitoba drain into Hudson Bay. The Red River flows from Minnesota northward into Lake Winnipeg (*see* Red River of the North). Its principal tributary is the Assiniboine, which rises in eastern Saskatchewan and joins the Red River at the city of Winnipeg. The Winnipeg River flows into the southeastern end of Lake Winnipeg, the Saskatchewan River into its northwestern end. The lakes in turn drain out the Nelson River into Hudson Bay. The Churchill and Hayes flow across the forested Laurentian Plateau into the Bay.

The many lakes and forests provide beautiful vacation resorts. Riding Mountain is a national park covering 1,148 square miles on the summit of the Manitoba escarpment (*see* National Parks). Whiteshell Forest Reserve (1,000 square miles) is a rugged section in the Laurentian Plateau east of Winnipeg. Straddling the United States border, in Turtle Mountain Forest Reserve

Extent.—North to south, 760 miles; east to west, 495 miles. Area 246,512 square miles, 26,789 of which are water. Population (1951 census), 776,541.

Natural Features.—Great prairies in southwest and south, with broken and hilly land of the Laurentian country in the north and east. Highest elevation, Riding and Duck mountains. Lakes Winnipeg, Winnipegosis, Manitoba, and numerous small lakes. Principal rivers: Red River, Assiniboine, Saskatchewan, and Winnipeg, draining into Lake Winnipeg; Nelson, draining Lake Winnipeg into Hudson Bay; Churchill and Hayes, also emptying into Hudson Bay.

Products.—Wheat, barley, cattle, oats, milk, hogs, flaxseed, eggs poultry, hay and clover; meat, butter and cheese, flour; railway rolling stock; clothing; copper, gold, zinc, cement; fur; lumber; fish.

Cities.—Winnipeg (capital, 235,710), St. Boniface (26,342), Brandon (20,598), Flin Flon (9,899), Portage la Prairie (8,511), Transcona (6,752).

in the southwest, is the International Peace Garden.

Manitoba has a continental climate with great extremes of heat and cold. Winter lasts from November to March. The temperature may reach 50 degrees below zero, but the air is dry and sunny and the snowfall is comparatively light. Although the growing season is short, crops mature rapidly during the long, hot, summer days. Most of the rainfall, which averages 20 inches annually, occurs in the spring and early summer.

Natural Resources Are Varied

Furs, forests, fish, and minerals provide Manitoba with a rich variety of natural resources. Muskrat is the most important fur-bearing animal. In 1935 the provincial government began an outstanding conservation program. More than a million acres of marshes north of The Pas are now under government control. Trappers are licensed, and the catch and sale of furs are carefully regulated. In the far north Indian and half-breed trappers still catch fox, beaver, and many other animals and trade the pelts to the historic trading posts of the Hudson's Bay Company. In the southern part of the province fox and mink are raised on fur farms.

The Laurentian Plateau has vast stands of spruce, aspen, and jack pine. In the south, seven forest reserves contain good supplies of timber. Elm, oak, ash, and other hardwoods grow along the river valleys of the prairies.

The fresh-water fisheries of the lakes are valuable. Whitefish, sauger, and Lake Winnipeg goldeye are the chief species. Sport fishing attracts many visitors.

The Laurentian Plateau also contains a vast wealth of minerals. The huge mine at Flin Flon on the Saskatchewan border is one of the greatest producers of copper and zinc in the world. The Sherritt-Gordon mine at Sherridon produces copper, zinc, gold, silver, cadmium, selenium, and tellurium. Gold and silver come from Gods Lake. During the second World War new gold deposits were discovered at Snow Lake, copper and nickel at Lynn Lake. The Bird River area in the southeast is a source of chromite, copper, nickel, and lithium. In the southern part of the province are cement, limestone, and gypsum.

From Wheat to Diversified Farming

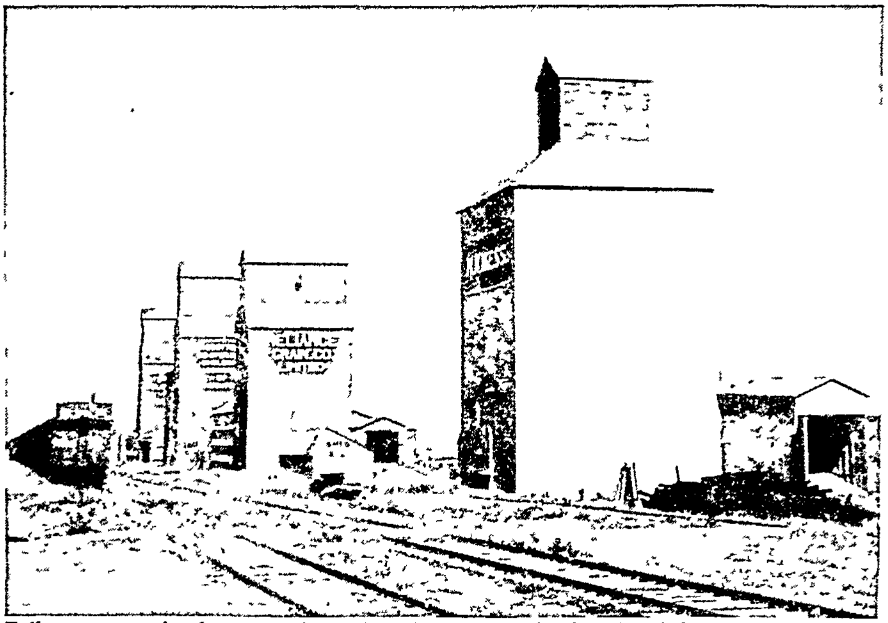
The rich soil of the Red River valley attracted the first permanent settlers in Manitoba. With the development of early maturing and frost-resistant strains of wheat, this became one of the world's greatest grain-growing areas. Wheat is still a leading crop, but diversified farming is now practised. Barley, oats, alfalfa, and clover are important field crops. Flax, soybeans, and sunflowers are raised for the production of vegetable oils. Sugar beets, beef and dairy cattle, hogs, sheep, poultry, fruits, vegetables, and honeybees provide a substantial income.

Manitoba's central position between the agricultural west and the industrial east of Canada has always given it an advantage over the other prairie provinces as a commercial center. With the development of water-power resources, manufacturing has increased. Meat packing is the leading industry of the province, centering in St. Boniface. Railway rolling stock, flour, butter, and cheese are next in value. At Winnipeg is a large sugar refinery which absorbs the sugar-beet production of the Red River valley. Newsprint is manufactured at Pine Falls, and hundreds of small mills provide the local markets with lumber and wood products. Dyeing and dressing muskrat furs is a major industry. Winnipeg, the railroad center of the prairies, manufactures freight and passenger cars and locomotives.

About 65 per cent of Manitoba's people are Canadian born, half of them of British origin. The original French settlers have been reinforced by a substantial migration from Quebec. St. Boniface is the center of the French-speaking people. Iceland farmers and fishermen settled in and around Gimli between Lakes Manitoba and Winnipeg in the 1870's. The Mennonites, Ukrainians, Poles, and Russian Dukhobors long retained the folk ways of their homelands, and the farming communities in which they live look more European than Canadian. They are now becoming more like their fellow Canadians.

Most of the population centers have grown up along the railroad lines across the southern prairies. In the far north, the only urban centers are on the Hudson Bay Railroad—The Pas, at its starting point; Churchill, the terminus on Hudson Bay; and the mining towns of Flin Flon and Sherridon. The wild

PRAIRIE GRAIN ELEVATORS



Tall, narrow grain elevators, visible for miles, are the landmarks of the western prairies The elevators stand every six or eight miles along the rail lines. Prairie farmers do not store their grain in barns, but haul it directly to the railroad.

FUR TRAPPING AND FISHING ARE MAJOR INDUSTRIES

The men on the left are stretching muskrat pelts over wooden stretchers to dry. In 1935 the provincial government began to restore the marshes along the Saskatchewan River which had been destroyed by drought. Under wise regulation, the trappers now have an assured year-round income. On the right, fishermen are drawing in the day's catch from frozen Lake Winnipeg.

interior is served by airplanes and, in the winter, by tractor-drawn trains of sleds. Ilford on the Hudson Bay Railway is an important center for tractor freighting to the mines on Gods Lake and beyond. A journey of 125 miles takes 60 hours.

Public schools are administered by the Provincial Department of Education and financed partly by taxation and partly by provincial grants. The University of Manitoba in Winnipeg was founded in 1877. Affiliated with the University are the colleges of St. Boniface (Roman Catholic, at St. Boniface); St. John's (Church of England), United (United Church), St. Paul's (Roman Catholic), all at Winnipeg, and Brandon, at Brandon.

The Early Fur Traders

The name Manitoba was given to this region by the Indians. Some believe that the Ojibways thought it was especially favored by the Great Spirit. In the narrows of Lake Manitoba, the roaring sound made by the water was his voice. So they called the country "Manito-Waban"—the Great Spirit's Narrows. Other authorities believe that it is a Sioux word meaning "Lake of the Prairies."

The first white man to see Manitoba was the English navigator, Sir Thomas Button. In 1612 he sailed from England in command of two vessels to explore the great northern waterway discovered by Henry Hudson two years earlier. He spent the winter on the western shore of Hudson Bay at the mouth of the Nelson River, which he named for the master of one of his ships.

When the Hudson's Bay Company was organized in 1670 it established trading posts on the shores of the bay. Fort Nelson (later York Factory), between the mouths of the Nelson and Hayes rivers, and Fort Prince of Wales at the mouth of the Churchill River, were the earliest of these posts within the boundaries of modern Manitoba.

In 1688 the Hudson's Bay Company sent Henry Kelsey up the Churchill River to open trade with the Indians. During the next four years he wandered far inland to eastern Saskatchewan. For another 40 years the English enjoyed a monopoly of the fur trade in western Canada. In 1734 Pierre Gaultier de Varennes (Sieur de la Vérendrye) and his three sons established French forts in southern Manitoba. Fort Rouge (later abandoned), where Winnipeg now stands, Fort la Reine near the present Portage la Prairie, Fort Dauphin on Lake Dauphin, and Fort Bourbon on Cedar Lake were built between 1738 and 1741. After French rule in Canada ended in 1763, the Hudson's Bay Company governed all the vast area known as Rupert's Land.

The first settlement of farmers in Rupert's Land was the Red River colony, founded in 1811 by Lord Selkirk as a refuge for Scottish highlanders who had lost their lands. The Canadian fur traders of the North West Company and their half-breed followers, known as *métis*, were hostile. Fearful that the coming of farmers meant the end of their livelihood, they three times attacked and drove off the colonists. At the battle of Seven Oaks in 1816 the governor and 21 others were killed. The colonists returned, and in spite of frost, flood, and grasshopper plagues, they survived. Trade began to the south from the Red River to St. Paul, Minn. In 1856 as many as 500 of the two-wheeled Red River carts crossed the border with furs and other products. The métis, no longer hostile, became part-time farmers, although hunting remained their chief occupation.

In 1869 the newly created Dominion of Canada purchased Rupert's Land from the Hudson's Bay Company. The Red River colony was given no guarantee of rights to their lands, and, under the leadership of a métis named Louis Riel, they rebelled against the proposed transfer of the government to Canada. As a result of their resistance, the province of Manitoba was created in 1870, with special guarantees for the rights of the Red River colonists. (For the story of the two Riel rebellions and the controversy over the schools problem in 1890, *see* Canadian History.)

By 1878 Manitoba was linked with the railroads of the United States, and in 1885 the transcontinental Canadian Pacific railroad was completed. The province was now able to export its cash crop of wheat.

The fertile lands attracted many immigrants. In 1870 there were 12,000 people—1,500 whites; the remainder of mixed French and Indian ancestry. By 1891 the population was 150,000. The original, small province was extended west to the boundary of Saskatchewan in 1881, and north to the 60th parallel and Hudson Bay in 1912. (For Reference-Outline and Bibliography, *see* Canada; Canadian History.)

MANN, HORACE (1796–1859). The "father of the American public school" was Horace Mann. He was born May 4, 1796, on a farm at Franklin, Mass. His father died when he was 13, leaving him to a youth of work and hardship, with little time for school. The ambitious boy read every book he found and finally entered Brown University. He was graduated at the head of his class in 1819. He studied law at Litchfield, Conn., was admitted to the bar in 1823, and practiced for 14 years. From 1827 to 1837 he was in the Massachusetts state legislature. He was active in educational reforms and introduced the act creating the Massachusetts State Board of Education.

In the small district school system, there was little provision for children under ten, and smaller communities offered only a few years of schooling. As secretary of the first board of education, Mann set out to replace the district school with the township unit. He knew that improvement must begin with the teachers, and through his influence the first normal school was established in 1839.

In 1843 Mann spent five months in Europe, studying its schools. On his return he presented his seventh annual report to the board. This antagonized the Boston schoolmasters, who saw his praise of the Prussians' teaching methods as criticism of themselves. Still the report made him a national figure. His 12 annual reports and his periodical, *Common School Journal*, exerted great influence in raising educational standards (*see* Education).

In 1848 Mann was elected to Congress to fill the seat vacated by the death of John Quincy Adams. He was an ardent champion of free speech and labor. Despite personal danger, he defended Negroes in the courts. He broke with Webster over the slavery question. The Webster faction prevented his renomination in 1850, but Mann was re-elected as an independent.

Antioch College at Yellow Springs, Ohio, made him its president in 1853. He set out to establish higher education on a coeducational and nonsectarian basis. After six years of labor there, handicapped by lack of financial support, he died on Aug. 2, 1859.

MANTIS, or MANTID. Few living creatures are more pious looking than the "praying mantis." The insect looks like an old lady at prayer; yet, it is a bloodthirsty murderer and a cannibal. The hind part of its 3-inch long body swells out like an old-fashioned skirt. It raises the front of its body in a prim pose with its two big forelegs innocently folded beneath its small, triangular head. Concealed on the inside of those arms, however, are cruel, toothed claws.

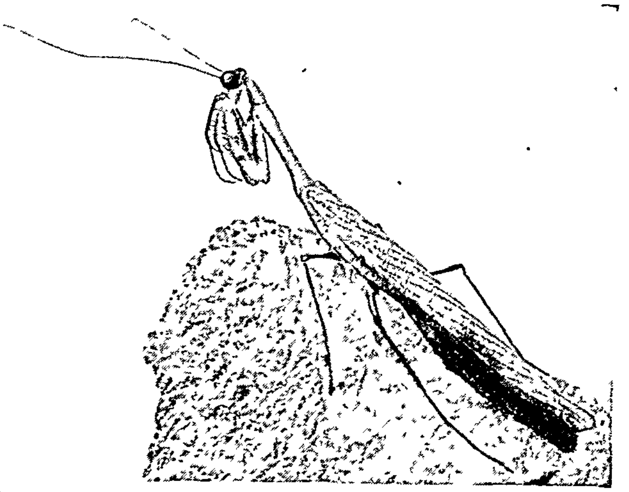
The mantis turns its head in a wide arc and looks for victims with its large compound eyes. If an insect ventures near, it does not see the mantis among the leaves because of its protective coloration and shape. Suddenly the long arms of the mantis shoot out, and the insect disappears into its greedy mouth.

The mantis eats useful insects, such as bees, but it also eats many insect pests. Mantes often fight and the victor devours the conquered. Sometimes the female consumes the male after mating. The female lays her eggs on a twig in a frothy mass, which when dry becomes a brownish, paperlike case.

This insect lives in tropical regions and also in temperate parts of the world. Most entomologists classify it in the *Orthoptera* (straight wings) order with grasshoppers and crickets. They call the family *Mantidae* from the Greek *mantis*, meaning "prophet." Some scientists put it in the separate order *Mantodea*. Its popular names include "mule killer," "soothsayer," and "devil's rearhorse."

About 1,600 species are known, some 20 of them in the United States. The *Stagmomantis carolina* is native to the South. About 1900, *Tenodera sinensis* from China and *Mantis religiosa* from Europe were introduced into the east accidentally. Later *Tenodera angustipennis*, another Oriental species, appeared. These species are now common in the northeast and east. Gardeners have "planted" egg cases in gardens and spread the mantis to northern and western states.

THE PRAYING MANTIS AT "PRAYER"



The mantis looks so prim and proper with its meekly folded "arms" and bowed head that it is called the "praying mantis." It would be nearer the truth to call it the "preying mantis," for this is just a pose that hides its fierce disposition.

MANUAL ARTS. Those arts in which the hands are extensively employed are commonly called manual arts (from the Latin word *manus*, meaning "hand"). They include working in wood and metal, book binding, block printing, weaving, sewing, basketmaking, and similar activities. Such arts as modeling and drawing are usually studied as "fine arts." (*See* Home Economics; Industry, American.)

The MAPLES, *Prized for* BEAUTY *and* USEFULNESS

MAPLE. Its thick, spreading foliage, which casts a cool shade in summer, and its brilliant coloring in autumn, make the maple one of the most popular trees for parks and streets. It is also a valuable forest tree, especially the sugar maple, which is the source not only of maple sugar, but of the most highly prized maple wood used for furniture and building.

Stalwart and handsome, the maple is easily recognized. It is a symmetrical, wide-spreading tree with a massive, domelike crown of extremely thick foliage. It is one of the relatively few trees with opposite branches, and both branches and twigs usually point upward. The leaf is broad, deeply indented, and varies in length in different species from two to five inches. The fruits are thin, paper-like wings, or keys, each bearing a seed at one end. They grow in pairs.

There are about 100 species of maple, all native to the north temperate zone. More than a dozen of them are native to North America. Among the most common species are the sugar, hard, or rock maple; the silver or soft maple; the red, scarlet, or swamp maple; the Norway maple; and the box elder, or ash-leaved maple. In the United States the maple family ranks third in commercial hard woods. Canada has adopted the leaf of this popular tree as its national emblem, and its national song is entitled 'The Maple Leaf Forever.'

THE SUGAR MAPLE, CHIEF OF THE MAPLE FAMILY

The sturdy trunk has a smooth gray bark when it is young, but the bark becomes rough and scaly as the tree ages. The leaves are simple, with three, five, or seven sharply pointed lobes. The winged seeds are called samaras, or keys. Notice the squirrel scampering up the trunk of the tree.

Although all of the maples have sweet sap, the sugar or rock maple is the source of practically all the maple syrup and sugar that is marketed. It is a tall, vigorous tree that grows to a height of from 70 to 120 feet. Its range is wide—from Newfoundland to Manitoba and south along the Appalachians to Georgia and eastern Louisiana. Sugar production, however, is commercially important only in northeastern United States and the neighboring parts of Canada, because the weather in the spring must be alternately freezing and thawing for a good run of sap. Continued cold or warm weather halts the sap flow. Sugar maples grow slowly and they are seldom good sap producers before they are 40 years old. They yield the greatest amount after they are 80. The sap begins to run in very early spring and flows for about a month. Each tree produces, on the average, about 10 gallons of sap. Boiled down, this yields about a quarter of a gallon of syrup, or two pounds of sugar.

The sugar maple also has the finest wood for manufacturing purposes. This tough, hard, close-grained wood is widely used in the manufacture of high-grade furniture, flooring, building interiors, aircraft and other vehicle construction, shoe lasts, and agricultural implements The ash is rich in potash and is used for fertilizer Gnarled sugar maples, called "bird's-eye" or "curly" maple, are prized because they can be cut into a handsome veneer for furniture. The black maple, which flourishes near streams and in river bottoms, is a variety of the sugar maple. It also is tapped for its abundant sugar sap, and its wood is similar to that of the sugar maple

The silver maple, which thrives in moist lands, is popular as a shade tree, because of its rapid growth. Its usual height is about 50 feet, but it often grows to 100 feet. The branches are long and gracefully drooping, with leaves that are pale green above and silvery-white beneath. The soft wood is used for furniture, veneer, and box boards. Another favorite ornamental tree is the box elder or ash-leaved maple, one of the smaller species. It is the only American maple with compound leaves.

The red, scarlet, or swamp maple, a medium-sized species, is one of the most beautiful of all trees in early spring. Before its leaves come out, the tree puts forth clusters of crimson blossoms. Throughout the summer the leaves are a filmy green. At the first hint of autumn they flame into crimson and gold.

The Norway maple has become widely popular in the United States as a shade tree in cities. Extremely hardy, it grows well even with such handicaps as heat, smoke, and hard pavements Other imported maples are the sycamore maple—an important hard wood in Europe, the European field maple, and the decorative Japanese maples.

Scientific name of sugar maple, *Acer saccharum;* of silver maple, *Acer saccharinum;* of red maple, *Acer rubrum;* of box elder, *Acer negundo.*

Making Syrup and Sugar from Maple Trees

OUT OF the white, hard months of the Vermont winter there suddenly comes a promise of relenting. A night along toward mid-March is starlit and brittle with cold. The veil of the Milky Way lies sharp and clear across the sky and the farmer can see his breath pluming out for several feet. But the next morning, after chores and before breakfast, he stops outside his house and looks about him. The deep-packed snow is beginning to thaw. His breath hardly shows at all and the sun is warm on the back of his hand. But there is something else too. As he goes in to his place at the head of the breakfast table, he informs the family that he "calculates the sap will run today."

He does not know *how* he knows, but he is very sure. The sap in the maple trees might have started to rise as early as the last week in February or as late as the first week in April. No outward signs are visible—no budding or any sign of greenness. And yet he knows when the time comes. His forefathers on this place knew also. Forty years between the planting of maple trees and the first harvesting of the sap is a long time in which to study—with another 40 years before the trees produce their maximum best.

The Indians knew the secret first and so the white man learned. On old trees you still can see the scars made by tomahawks, then those made by early whites—holes bored with an inch-and-a-quarter auger. Compare those with the half-inch drill holes of today. For the sugar maple is a long-lived tree. It is said that trees planted by the Pilgrims in 1620 are still giving sap.

WHEN THE SAP BEGINS TO "RUN"

It is the first day of the tapping season in this maple grove. With brace and bit the men are boring holes to let out the sap and hanging buckets to the trees to catch the flow.

How the Trees Are Tapped

Paths are beaten through the snow into the woods. The farmer and his helpers drill holes two inches deep into the trees about waist-high and slanting upward—one to three holes, depending on the size and sturdiness of each tree. Spouts are driven into the holes. Some farmers have a pipe-line system from the trees to the sugar house. Most farmers, however, hang pails on the spouts. The pails, usually of metal for ease in cleaning, are covered to keep out twigs and rain. The sap runs swiftly or slowly, according to weather conditions, and the quantity a tree will give depends on the amount of sunlight that reached the leaves the previous year. Prolonged cold stops the flow. Continuous warm weather—the kind that brings out the buds on the tree—ends sap-taking for the year, for "buddy" sap makes poor syrup. Crisp, cold nights, warm sunshiny days with alternate thaws and freezes make ideal "sugar weather." During the average month-long season, the sap will run only about half the days. "Good runs" may occur on as few as two days; seldom more than five.

From the buckets the sweet and colorless sap is collected into horse-drawn gathering tanks on sleds. In the small groves the sledge team usually hauls the sap directly to the camp, where it is boiled down over a log fire. The sap is ladled from one kettle to another until in the last one it is thick enough for syrup. In the larger groves, which may have as many as 5,000 trees, no boiling is done at camp. The sap is hauled to a "sugar house"—a low shed, with a towering chimney to give draft for the boiling fires. The sap is poured into long evaporators set on an "arch," a narrow brick or iron furnace.

Good Syrup Needs Careful Cooking

Few farm tasks require more patience and watchful care than the preparation of high-grade maple products. To produce the prized golden-colored syrup of smooth, mellow flavor, only a little of the sap is boiled in the evaporator at a time. Constant watch is kept with thermometer and hydrometer to test the thickness of the syrup, and all impurities are strained out through a felt matting. The syrup is canned quickly so that it will not become soured by bacteria growth. Or, if it has been boiled down to sugar, it is put into tin or wooden molds and packed carefully for shipment. Candy manufacturers use a large amount of maple sugar, but most of it is used to flavor and sweeten tobacco products.

Maple sugar and maple syrup are exclusively North American products. In the United States the output comes chiefly from Vermont, New York, Ohio, Pennsylvania, Michigan, and New Hampshire, although many other states produce small quantities. The southern and eastern parts of Quebec are the main producing areas of Canada.

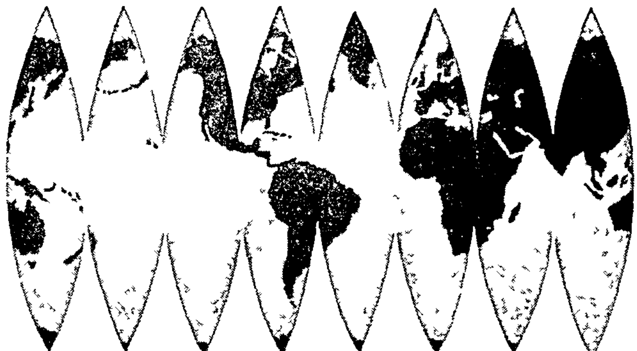
HOW MAPS *Help* Us to KNOW *the* WORLD

MAPS. Men have made and used maps since the dawn of history. They have done so because maps serve much better than words for giving many kinds of information. Even primitive peoples recognize this. When an explorer in a wild land asks directions from a native, the native often answers by drawing a map on the ground, on a shell, or on a piece of bark. Explorers have found the Eskimos unusually skillful in doing this.

Today maps are employed in countless ways. Schools use them constantly, not only in the study of geography, but as aids for understanding plant and animal life, history, and current events. Outside of school we encounter maps in almost every newspaper and magazine. Road maps guide us on vacation trips. Exceptional skill in the use of maps is required in many professions, such as civil engineering and geology, and above all in navigation, by sea or in the air.

Why Many Kinds of Maps Are Needed

When we first start to use maps, we may think that one map is very much like all others, except for differences in size, color, and workmanship. But if we are watchful, we soon see that great differences exist. Just a glance at later pages in this article will show, for example, that on some maps North America stands almost upright, while on others it is warped and almost lying on its side. On some maps the meridians, the parallels, or both, are straight, while on others they are curved in various ways.



The map maker must show a round earth on flat paper. He cannot do it with complete accuracy. To make the paper surface of a globe lie somewhere near flat, you would have to cut it and peel it off as shown here. The maps that cover globes are actually printed in gores like these. They are applied while moist enough to stretch a little and fit the curved surface without wrinkling.

These differences exist because of a difficulty which map makers always encounter, when they start to make a map of any large area such as a state, a nation, or a continent. As we know, the earth is round, and any large portion of its surface has considerable curvature. But a map is flat, and it is impossible to show a curved surface on flat paper with complete accuracy, as the accompanying pictures show. Something must be distorted.

The "Projection" of a Map

Fortunately, ways can be devised to show one or more aspects of the surface correctly, while letting distortion occur in other aspects only. Furthermore, map makers can choose which aspect they will show correctly. They can show true directions by distorting distances and areas; or they can give the preference to correct distances or correct areas. These different results can be obtained by varying the framework of meridians and parallels. (This framework is called the *grid* or *graticule* of the map.)

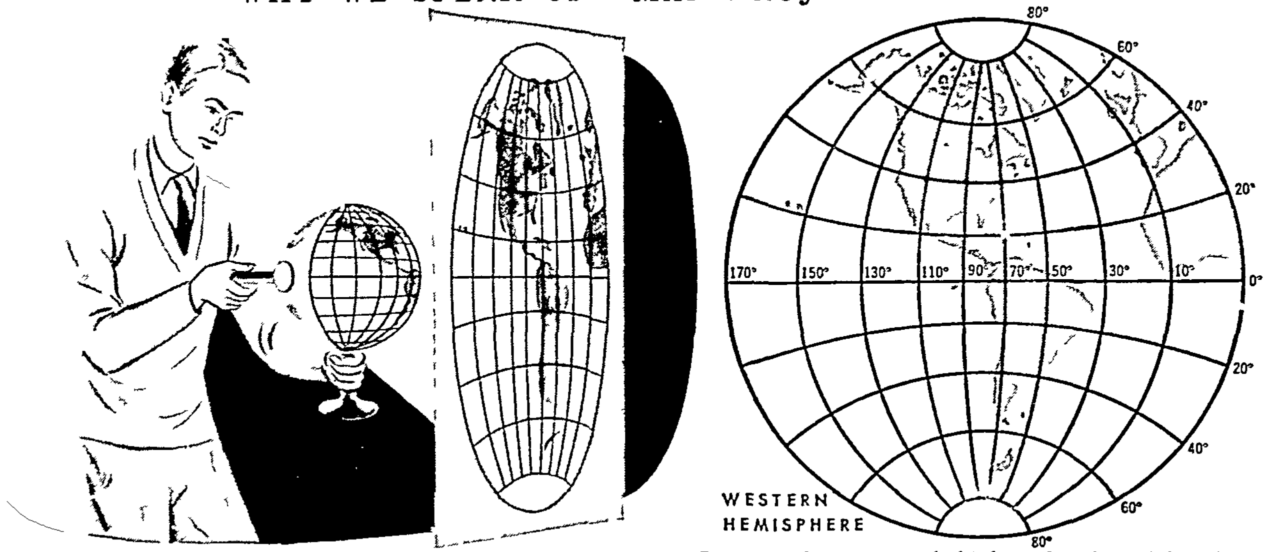
In actual map making, the variations are worked out by elaborate calculations; but the guiding principle can be explained very simply. Imagine that the area to be mapped has been drawn on a glass globe. If a light is placed to shine through the globe toward a screen, it will project the curved drawing upon the flat screen, and the projection can be traced to make a map. Hence the plan or design of the grid which is used in preparing a map is called the *projection* of the map.

By shining the light from different points, one kind of information or another can be shown correctly on the screen. In the accompanying picture, for example, the light is shining from a point on the globe exactly opposite the hemisphere which is being mapped. This shows the features of the land, such as capes, bays, and islands, with correct shapes but progressively enlarged from the center of the map to the edges. (This projection is called *stereographic*.)

If the light passes through the globe from a great distance, nothing is shown exactly as it should be; but the projection makes the land look as it would if viewed on a globe. Hence this projection (called *orthographic*) is often used for visualizing world-wide relations, of the sort called "global" or "air age" geography. A good example is the picture map with the article on the Gulf Stream.

Another projection can be illustrated by shining a light from the center of a globe upon a cylinder of paper. After the land has been traced, the cylinder can be opened to make a map. Actually this could only be done if the cylinder is outside the globe, and it would have to be enormously long to take the polar regions. This elongation can be lessened by calculating the projection as though the cylinder cut down through the earth. The picture shows this for a *Gall stereographic* projection. The calculations can also be adjusted to make the map show all compass direc-

WHY WE SPEAK OF "MAP PROJECTIONS"



Many kinds of maps resemble the pattern that would be produced on a flat screen by projecting light through a glass globe. A stereographic "projection," for example, would result from placing the light as shown here. Notice in the full-face view of this projection at the right how the parallels spread apart as they approach the sides of the circle.

tions correctly. The result is a *Mercator* projection (shown on a later page).

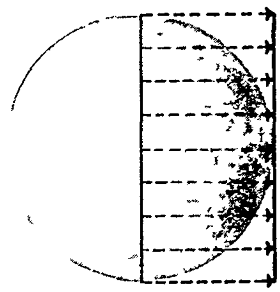
For showing countries or continents, a cone can be used instead of a cylinder, giving a *conic* projection. The cone can touch the earth along one parallel (called the *standard parallel*); but distortion is reduced if the cone cuts the earth along two standard parallels, as the picture shows. This projection is good for showing middle latitude regions, such as Europe and the United States.

Many other projections have been devised, each one to show certain aspects of the earth's surface to good advantage. Some can be imagined as projected from a globe; others cannot, and the grid can only be prepared by calculation. A selection of the most useful projections is shown on later pages.

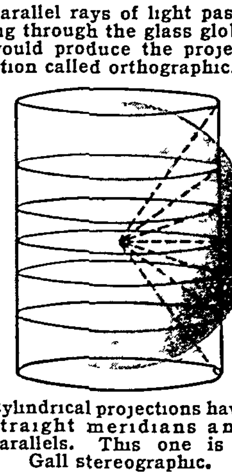
Showing Land Shapes Correctly

Many map users want the *shapes* of land features, such as capes, bays, islands, and mountain ranges, shown correctly. A navigator needs this in his charts in order to make his way safely along coasts and inland waters. An aviator needs it for cross-country and transoceanic flights.

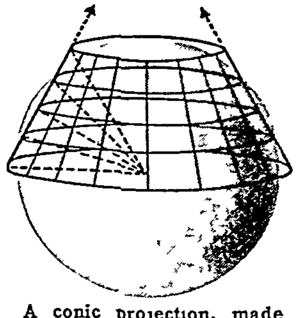
Maps which have this property are called *conformal* or *orthomorphic*. Their meridians and parallels form right angles with each other. Then shapes and proportionate distances are accurate in the vicinity of each intersection, and this insures correct shape of local land features. A Mercator projection has this property. So do others with curved lines in the grid, as long as the meridians and parallels cross squarely. This feature should



Parallel rays of light passing through the glass globe would produce the projection called orthographic.



Cylindrical projections have straight meridians and parallels. This one is a Gall stereographic.



A conic projection, made as shown, has slanting straight lines for meridians, but has curved parallels.

always be looked for in maps which are to be used for making models or drawings of regions.

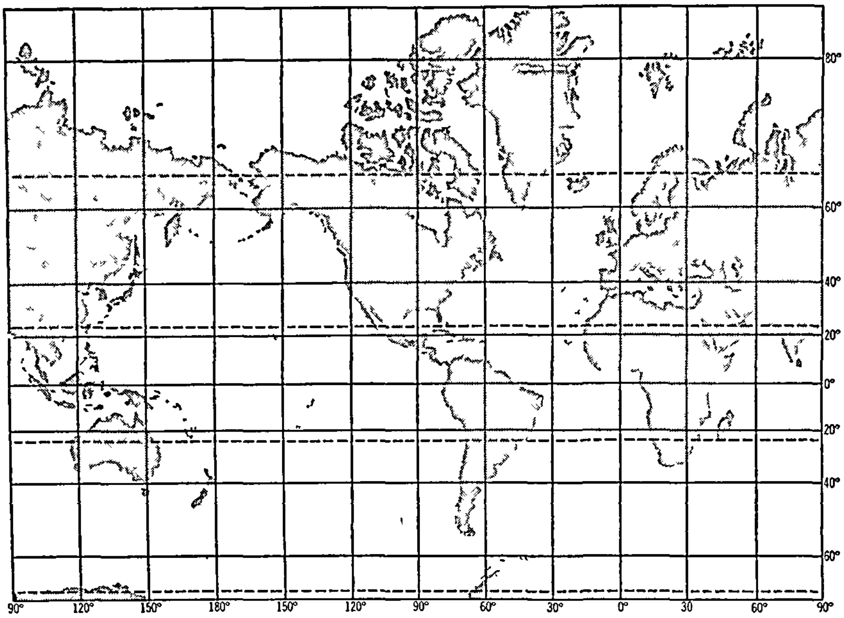
Map Scales for Showing Distances

An important feature of most maps is an aid for measuring distances. The commonest is a *scale of miles*. This is a line or bar, marked to show distances. To determine the mileage between any two points, mark off the distance between them on the edge of a piece of paper; then lay the marked paper along the scale.

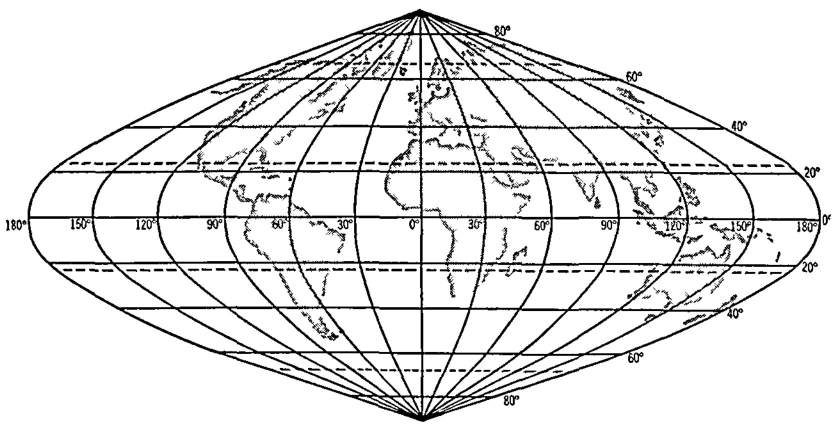
The markings are spaced on the bar according to the relation (also called the scale) between the size of the map and the extent of the earth's surface which is shown. If a map is six inches square, and it shows an area 7,500 miles on each side, plainly one inch on the map represents 1,250 miles on the earth. This would be roughly the ratio if a map of Asia should be printed across a page of this encyclopedia. To mark a scale in hundreds of miles on such a map, we would allow 2/25ths of an inch for each hundred, and 4/5ths of an inch for each thousand miles.

Another aid, given on some maps, is a statement of how many miles are represented by one inch. For our map of Asia, this would be "1 inch = 1,250 miles." When this is known, an ordinary ruler can be used to measure distances, and the measurement can then be converted into miles. On some maps, the ratio between map size and earth size is printed. In our example, this would be about 1 to 80 million (accurately, 79.2 million, since this is the number of inches in 1,250

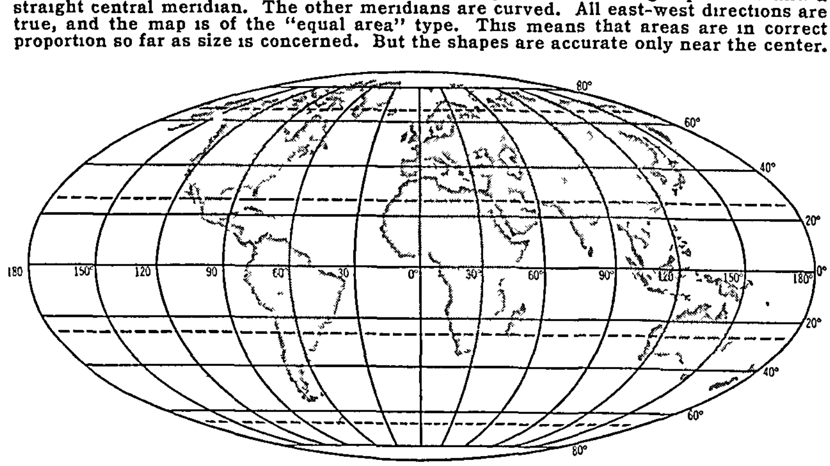
SHOWING THE ENTIRE WORLD ON ONE MAP



The Mercator projection with straight meridians and parallels is used by navigators because *it shows true compass courses. That is, the compass course between any two points* on the earth is the same as the direction shown on the map. Areas, however, are badly distorted, those toward the poles being tremendously exaggerated.



The sinusoidal or Mercator-Sanson-Flamsteed projection has straight parallels and a straight central meridian. The other meridians are curved. All east-west directions are true, and the map is of the "equal area" type. This means that areas are in correct proportion so far as size is concerned. But the shapes are accurate only near the center.



The Mollweide projection is like the sinusoidal, except that the curved meridians are drawn as ellipses. It has true east-west directions and the areas are in correct proportion. The shapes of areas near the poles are better than on the sinusoidal. Hence this projection is favored for world-wide showings of population, rainfall, and the like.

miles). The relation may be printed as a ratio (1:80,000,000) or as a fraction ($\frac{1}{80,000,000}$).

Choosing a Projection to Suit a Purpose

The sketch maps on these pages and later ones show the projections most commonly used, and emphasize the features which enable us to recognize these projections The first six, shown on these two pages, are used to display the entire world on one map, and each one has its own good features and disadvantages.

The first is the Mercator projection, used by all mariners because it shows compass courses correctly. It is also used for showing conditions the world over in matters such as population and rainfall, but this use creates false impressions, because the areas toward the poles are enormously exaggerated. Greenland, for example, looks larger than South America although it is, of course, much smaller.

The remaining maps are designed to avoid giving such false impressions by showing all areas in correct proportion. Hence they are called *equal area* maps. Three of them also have horizontal parallels, making it easy to compare all places in the same latitude straight across the map. All but the last one, however, have considerable distortion of shape, especially in the polar regions and toward the sides.

The sixth map, on an interrupted projection, has the least distortion of any. The use of split portions, or gores, gives several straight meridians in each hemisphere, instead of just one for the entire map. This gives improved shapes in each gore. The straight meridians can be placed on the continents as shown here, or on the oceans, if an ocean map is desired. Several projections of this sort, devised by J. Paul Goode, have come into widespread use in geographic studies.

The last four projections on these two pages are useful only for showing the entire world; but the Mercator and the sinusoidal offer certain advantages for show-

ing portions of the earth such as continents and countries, if the region represented lies within 20° or 30° north or south of the Equator. The Mercator is simple, and in these latitudes the distortion of distance and area is not excessive. The sinusoidal shows distances, areas, and east-west directions truly, with only slight distortion of other directions and of shapes.

Other projections are even more commonly used for regional maps, because of various advantages. Some of them, of particular value for "global" or "air age" studies, are shown on a following page. The *gnomonic* projection ranks with the Mercator for usefulness to navigators of airplanes and high-speed steamships. It corresponds to a projection obtained by shining a light from the center of a transparent globe upon the inside of a square paper box which touches the globe at the center of each face. Opening out the box gives a map of the entire world.

How Maps Show Height of Land

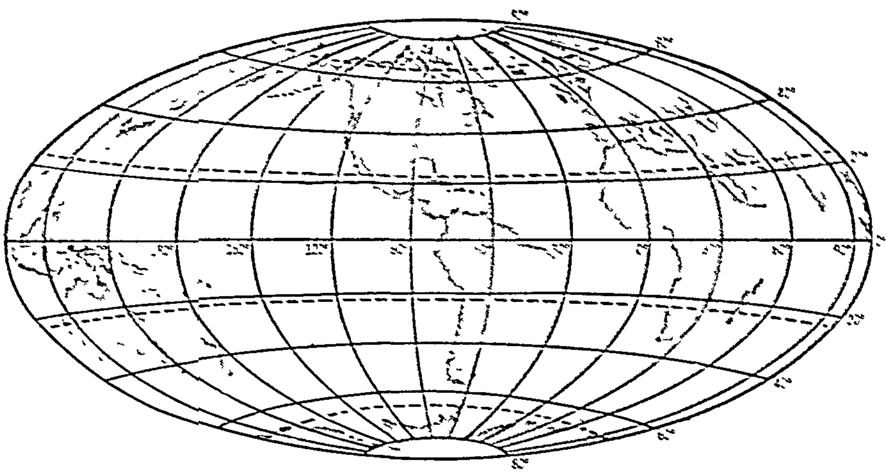
Often we want a *relief* or *topographic* map to show the height of the land, and features involving height, such as mountains, mountain passes, valleys, and plains. This information is valuable for studies in history and current events because mountains, passes, and plains have a strong influence upon the lives, movements, and destinies of peoples. Climate depends upon height or altitude just as much as it does upon distance from the Equator, or latitude. Knowledge of heights is vital to engineers who must plan roads and railroads, and to aviators when making cross-country flights.

Height can be indicated by visualizing land surfaces with some kind of shading. A common type of shading is accomplished by *hachures*. These are short lines, drawn along sloping land in the same direction that water would flow. On a steep slope, like the side of a mountain, the lines are heavy and close together. On gentle slopes they are thin and widely spaced. Level land is shown by the absence of lines.

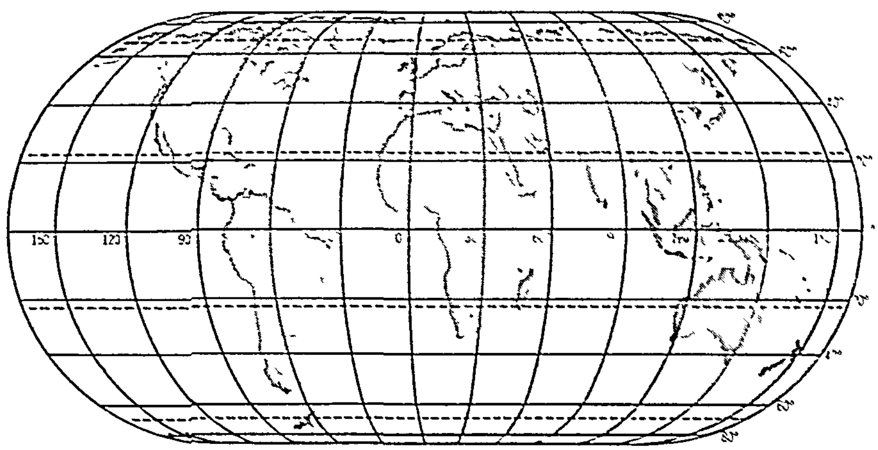
Another method called *plastic* shading is often used on modern maps. It imitates the effect of shining a light almost horizontally across a relief model of the land. This brings out elevations by placing shadows behind them. Many colored physical maps in this encyclopedia were made by this method.

Shading shows relative elevations of neighbl areas; it does not specify heights al

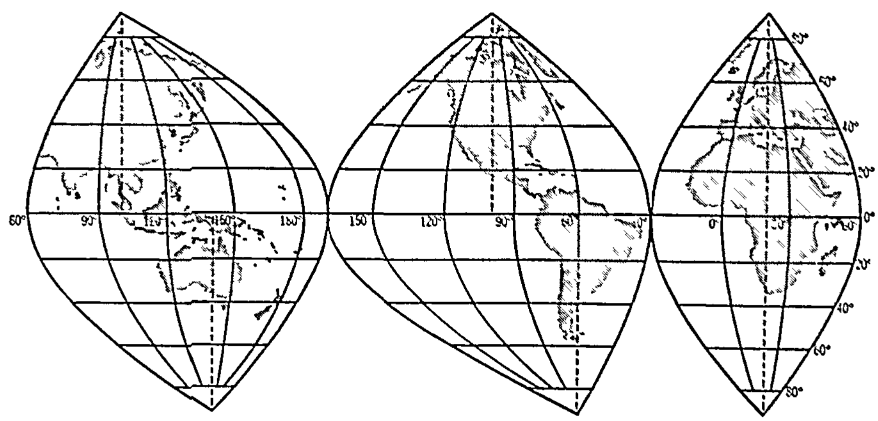
THREE SPECIAL PROJECTIONS OF THE WORLD



In the Aitoff projection, only the central meridian and the Equator are straight. It gives a correct (or "equal") showing of areas, and shapes are somewhat better than they are in the Mollweide or sinusoidal projections. But the curvature of the parallels makes more difficult a detailed comparison of places in the same latitude.

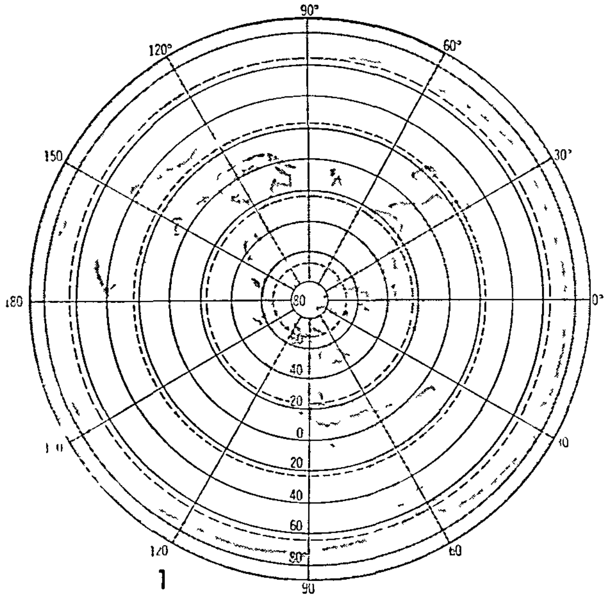


In the Eckert projection each pole is shown as though stretched out into a line, instead of being shown as a point. This gives a distinctive, easily recognized shape. The advantages are correct or "equal" areas, straight parallels for latitude comparisons, and much less distortion in the shape of land masses.



Interrupted projections can be made from the others on these two pages (except the Mercator) by a process which resembles the gore-cutting shown on the first page of the article. This gives for each segment or gore a straight central meridian, and excellent shapes near it. But the gaps between gores create some difficulties.

MAPS FAVORED FOR "AIR AGE" GEOGRAPHY



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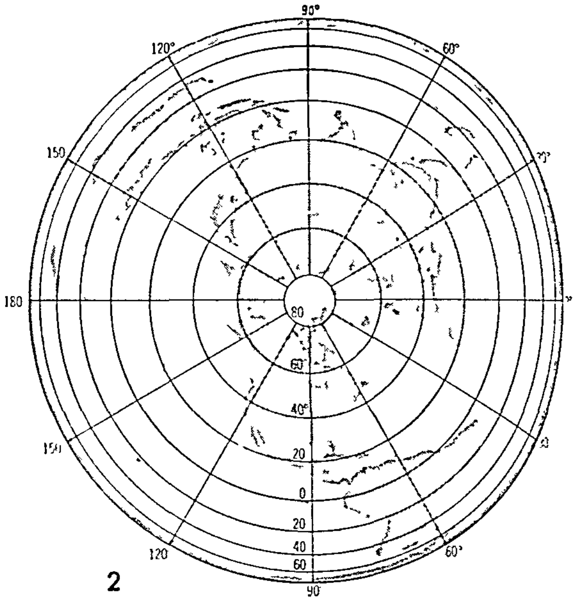

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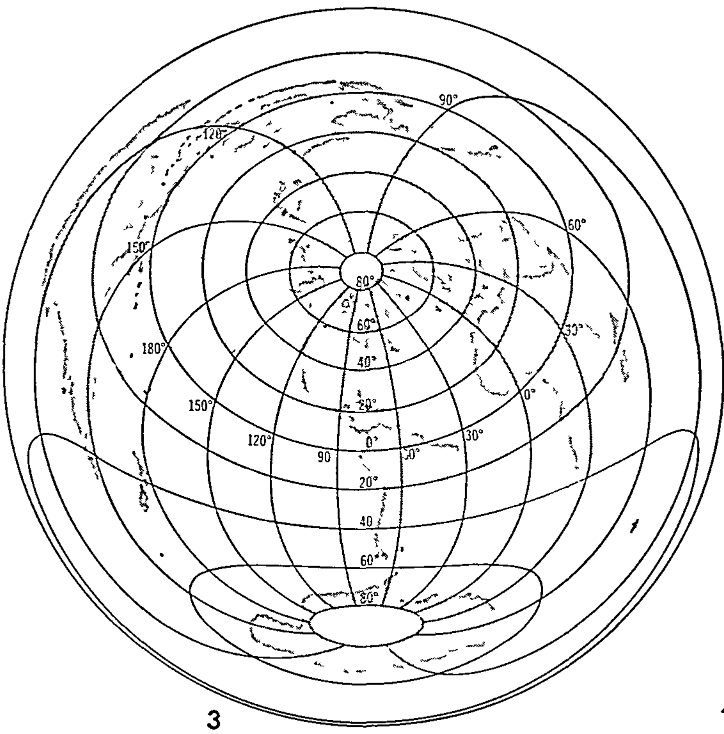

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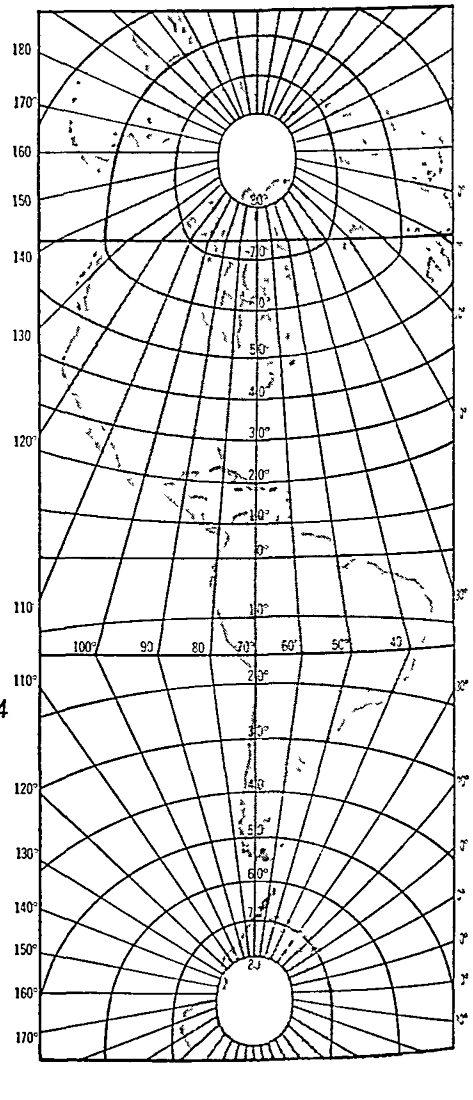
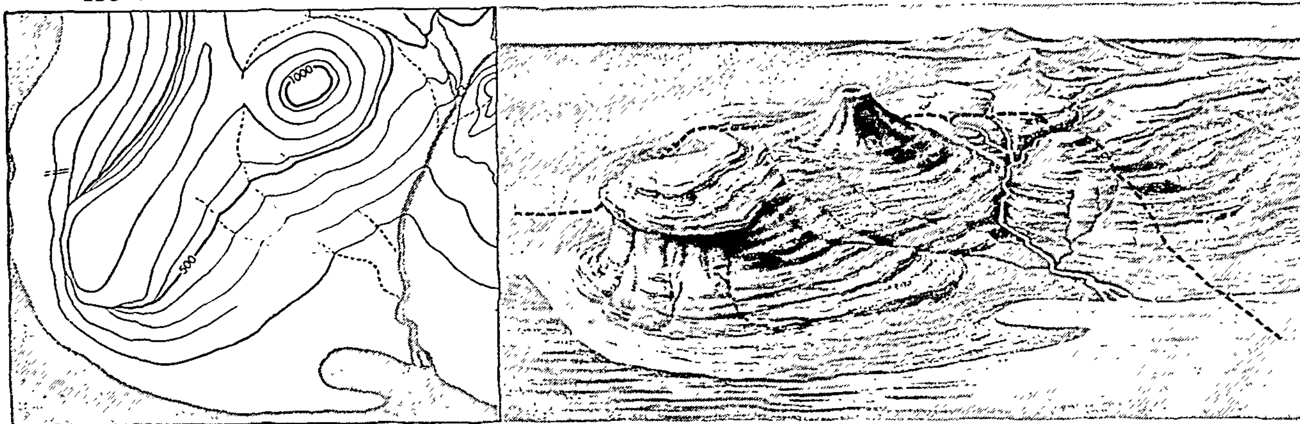


4

These maps are leading choices for showing world-wide or "air age" distances and related facts. On the Polar Equidistant map of the world (1), all distances from the North Pole are shown correctly, at expense of distortion in shape and area toward the edges of the map. The world looks much the same in a Polar Equal Area map (2); but on it areas are shown correctly, while distances and shapes are distorted. To tell the maps apart, notice that the circular parallels of latitude are equally spaced on the Equidistant map. On the Equal Area, they are closer together toward the edge. Notice also on each map how Antarctica forms a rim around the edge. Equidistant maps can be drawn to show true distances from points other than a pole. The example shown (3) has Washington, D. C., as the central point. This projection can be identified by the odd-looking parallels and meridians. Gnomonic maps, such as the one of North and South America (4), show great circles as straight lines. These maps are used by navigators of steamships and long-distance airplanes because the shortest distance between two points on the surface of the earth is always a great circle.

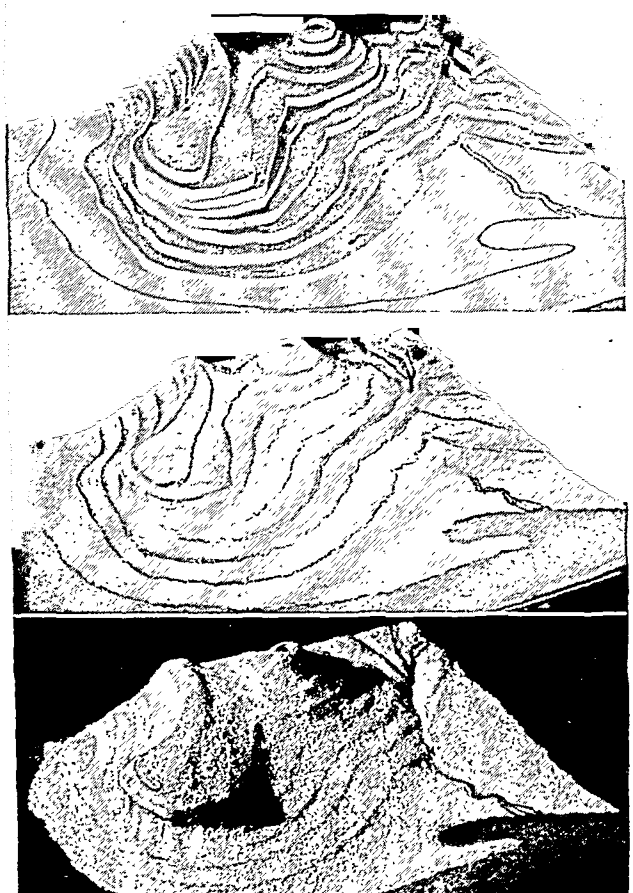
HOW CONTOUR LINES SHOW THE ELEVATION AND SHAPE OF THE LAND



Above (left) is a contour map of a varied land area, and (right) a bird's-eye sketch of the region. (The dotted line shows the part covered by the map.) A comparison of the map and the picture will show how the contour lines set forth the plateau and overhanging cliff (left), the volcanic peak (center), and the river valley (right). Sharp slopes are shown by close spacing of the lines, and gentle slopes by wide spacing. Notice too that no contour line crosses another one, except where the overhanging cliff is shown. Finally, see how the river is shown by V-shaped bends in the contours, with the points of the V's directed upstream.

This can be done by using different colors. A good example is the relief map with the article on South America. On it, shades of green are used for heights up to 1,000 feet above sea level. Yellow is used for the next 1,000 feet, and then shades of red and brown. Shades of black are used for ocean depths. (Many maps use blue for this purpose.) Colors used in this way are called *hypsometric tints*.

MAKING A RELIEF MODEL BY CONTOURS



Here are three steps in making a model of the land shown at the top of the page. First, shapes are cut corresponding to the areas inside each contour line and stacked. Next, the stack is shown coated with plastic material. Lastly, a finishing coat is applied. Further explanations are given in the article.

Showing Height by Contour Lines

The most accurate way to show height is by use of contour lines. Each line is drawn to run through all the points on a map which lie at the same height above sea level. A simple example of this is a line for a seacoast. Since the surface of the ocean is at the same level everywhere, so is every seacoast. Hence every line on a map which shows a seacoast is a contour line. It runs through points which lie at zero height above sea level and no others.

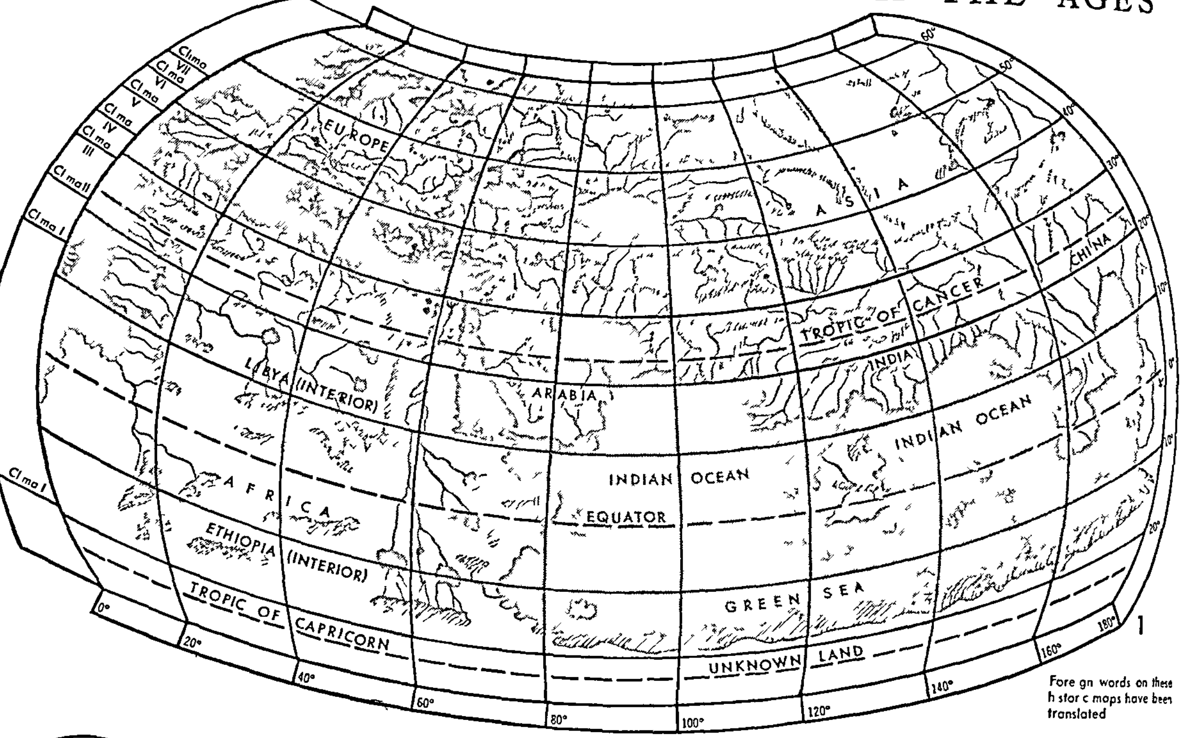
If similar lines are drawn at desired intervals, say for every 20-foot rise in altitude, they will show every part of the land that lies at each level—20, 40, 60 feet, and so on. How these lines taken together reveal the shape of land features such as mountains and valleys is made plain by the accompanying illustrations. To aid in determining height, every fifth line is made heavier than the others, and is marked with its elevation. In the sketch map, the contour interval or height between levels is 100 feet, and the heavier, marked lines are those for 500 and 1,000 feet above sea level.

Making a Model from a Contour Map

Accompanying pictures show how a model of a region can be made from a contour map. The shape of each wooden layer can be obtained by tracing each successive contour line upon a separate piece of transparent paper. The tracings may be used directly as guides in cutting out the layers, if a model of the same size as the map will serve. If the model is to be bigger than the map, enlarged copies of the tracings will have to be worked out. A convenient method is to make the original tracings in black ink, photograph them, and project each negative to the desired size upon white paper. From this the lines can be retraced easily.

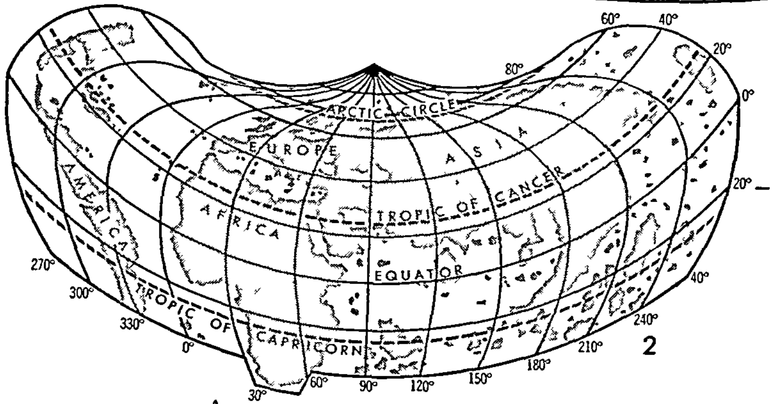
When assembled, the layers should be waterproofed with shellac. A good surface can be placed on the model with a wet mixture of sawdust, ground asbestos, and wallpaper paste. Several coats may be needed,

DEVELOPMENT OF MAPS THROUGH THE AGES



1

Foreign words on these historic maps have been translated



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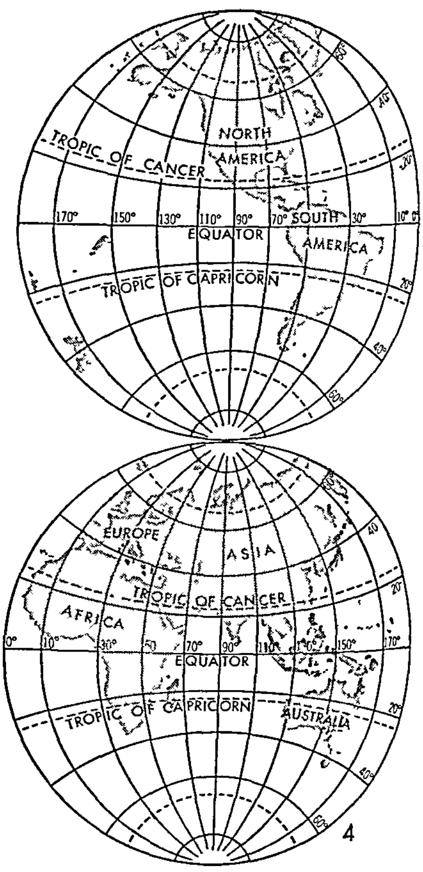

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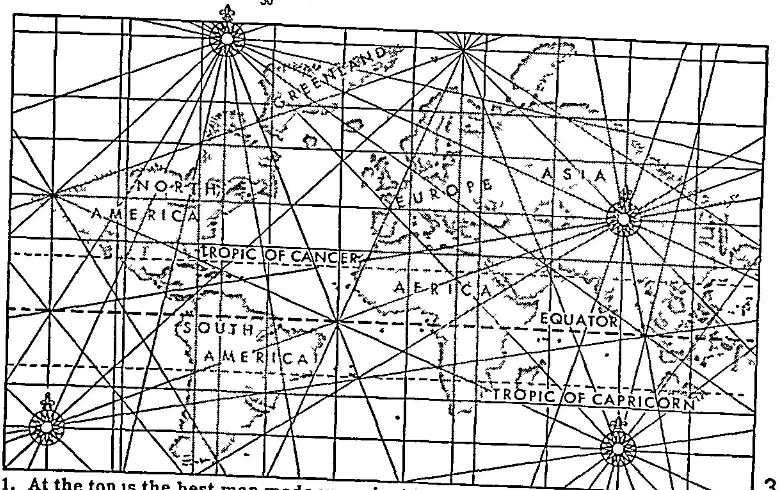
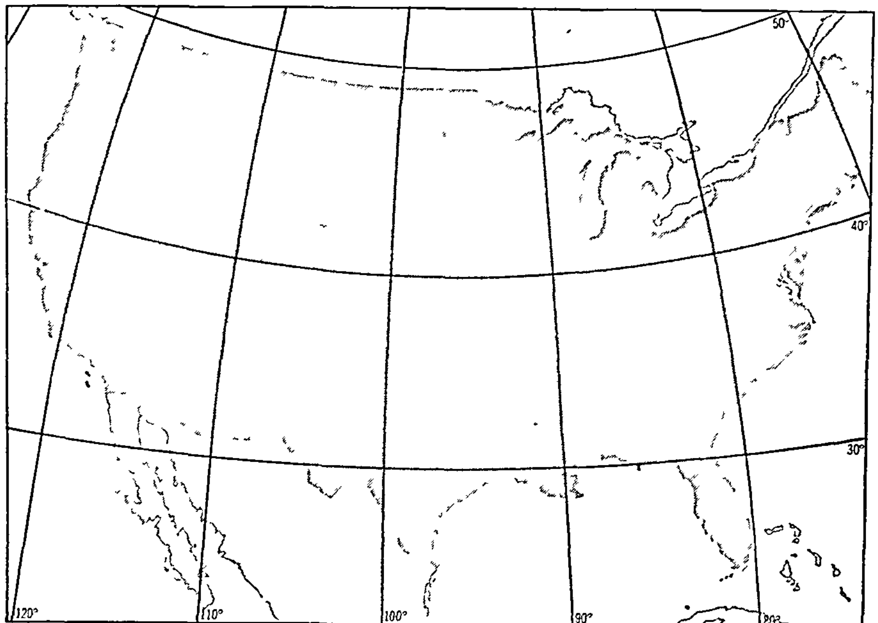


3

1. At the top is the best map made in ancient times. It shows the inhabited world as known to the maker, Ptolemy. On the left edge are indications called *climas* of supposed climate zones. The picture is from a reproduction made about the time of Columbus. 2. This map was made in 1507 by Martin Waldseemuller. It was the first to use the name "America." 3. Less than a century later, knowledge of the world had grown to the extent shown in this English map, printed in 1599 in a book by Richard Hakluyt. 4 These hemispheres, produced by D'Anville in 1760, show that by this time the continental outlines were known, save for the Arctic coast of North America, part of Australia, and Antarctica. (Latitudes and longitudes on the map are from the originals.)

since the first ones usually crack along the edges of the layers as they dry and shrink The final surface will be slightly rough, like actual earth. A smoother finish can be obtained by coating with plaster, mixed thinly enough to spread easily. Either surface can be painted to indicate water, rock, vegetation, and the like.

TWO GRIDS FOR MAPS OF THE UNITED STATES



A map of the United States usually employs one of these projections. At the top is the two-parallel conic projection used in many recent maps. It has straight meridians and curved parallels. At the bottom is the more common polyconic projection, with curved meridians and curved parallels. Most government maps use this projection.

The History of Map Making

In all the early civilizations men knew how to make maps of local areas. The ancient Greeks were the first to attempt accurate maps of the entire world as they knew it, using latitude and longitude, and locations determined by astronomical observations. All their knowledge, and many erroneous ideas, was contained in maps drawn by Ptolemy of Alexandria in the second century of the Christian Era (*see* Ptolemy).

During the Middle Ages, the art of map making was almost forgotten in Europe. It was revived when the compass came into use, and mariners began making long voyages. In the 14th century the Italians and the Catalans produced excellent charts, called *portolani*, of the Mediterranean. The charts were marked by a crisscross of lines to help in laying compass courses. This feature of a *portolano* is retained in the English map of 1599.

About the time of Columbus, Europe obtained Arabian copies of Ptolemy's maps, and the newly invented art of printing spread them far and wide. This revived the use of latitude and longitude on maps. Then came the great voyages of discovery, and map makers soon developed new projections to meet the need for good maps on a worldwide scale. They were troubled, however, by east-west distances, because longitude could not be determined accurately. The invention of the telescope made it possible to do this from astronomical observations. The leading maritime nations established observatories to promote this work; and in 1682 J. D. Cassini, working on the floor of the Paris Observatory, produced the first really accurate map of the world.

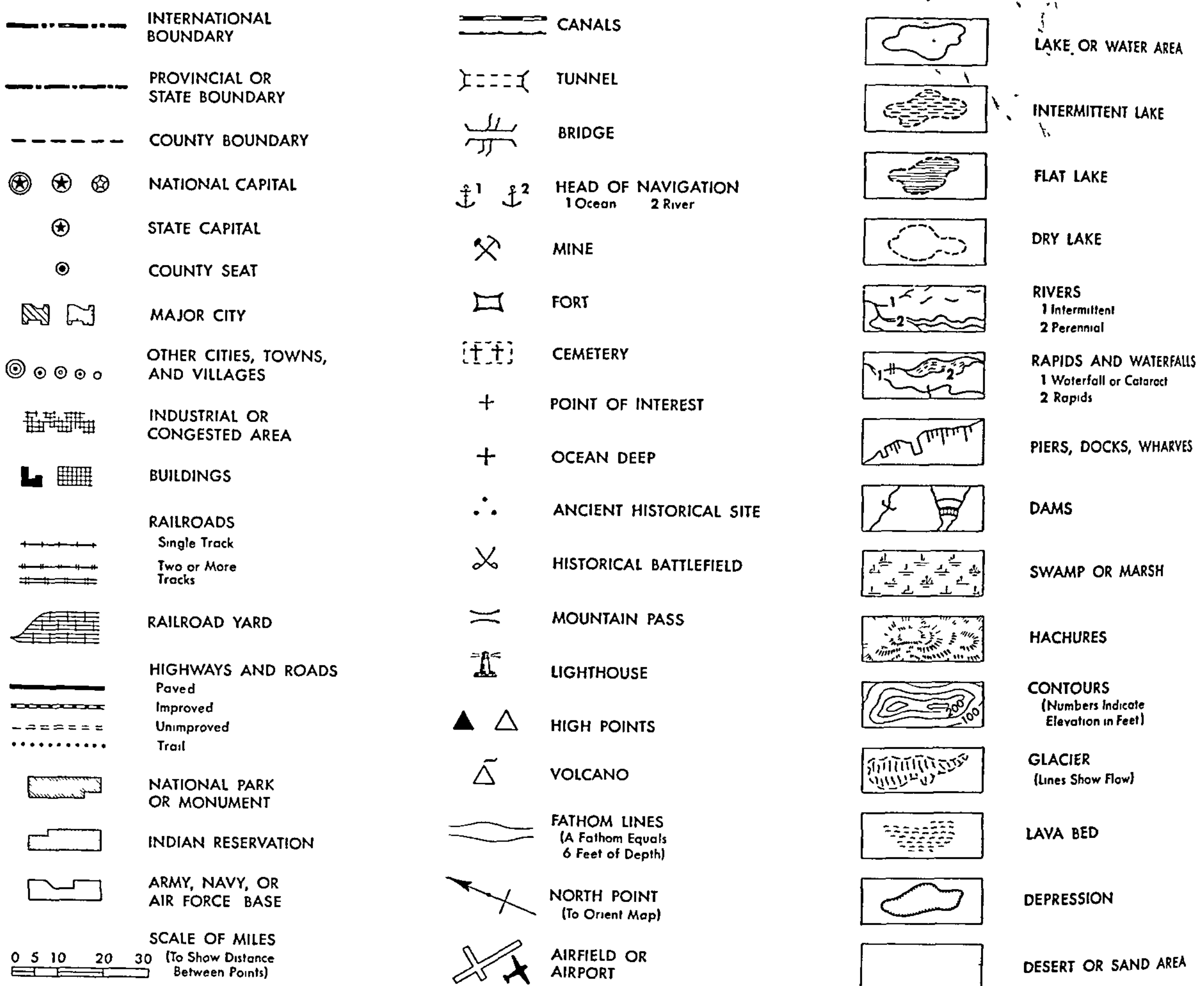
At that time great wars were being fought, and military demand for maps inspired a rapid development of land mapping. A grandson of J. D. Cassini, C. F. Cassini, led in this, by using the newly invented method of triangulation to produce an excellent map of France (*see* Surveying). A little before the American Revolution a German mathematician, J. H. Lambert, made many improvements in the mathematical theory of map projections, particularly those which have equidistant and equal area properties.

In the 19th century inexpensive maps were made possible by the invention of wax and photoengraving. The 20th century brought aerial photography to the aid of map makers (for picture, *see* Photography).

Map Symbols and Conventions

To give information quickly and graphically, every map uses a great number of symbols and conventions. A map symbol is a little picture. It may be fairly realistic, such as little tufts of grass to indicate

COMMON MAP SYMBOLS AND CONVENTIONS



The map symbols and conventions in this table are common ones used on many political and physical maps. Map makers use countless others not shown. In a few instances, alternate symbols are given for the same feature. The map maker chooses the one which best suits the design and purpose of the map. Notice how some symbols are actually little pictures; others suggest the shape or outline of the physical or political feature; and still others, such as the boundaries, are arbitrary choices.

marsh or swampland, or it may only be suggestive, such as a star to indicate a capital city. A convention is an arbitrary usage or method that all map users accept. One such accepted usage is the width of lines used in drawing roads, rivers, and railroads. These are always much wider than the scale of the map would actually permit. If the lines themselves were in scale, they could not be seen.

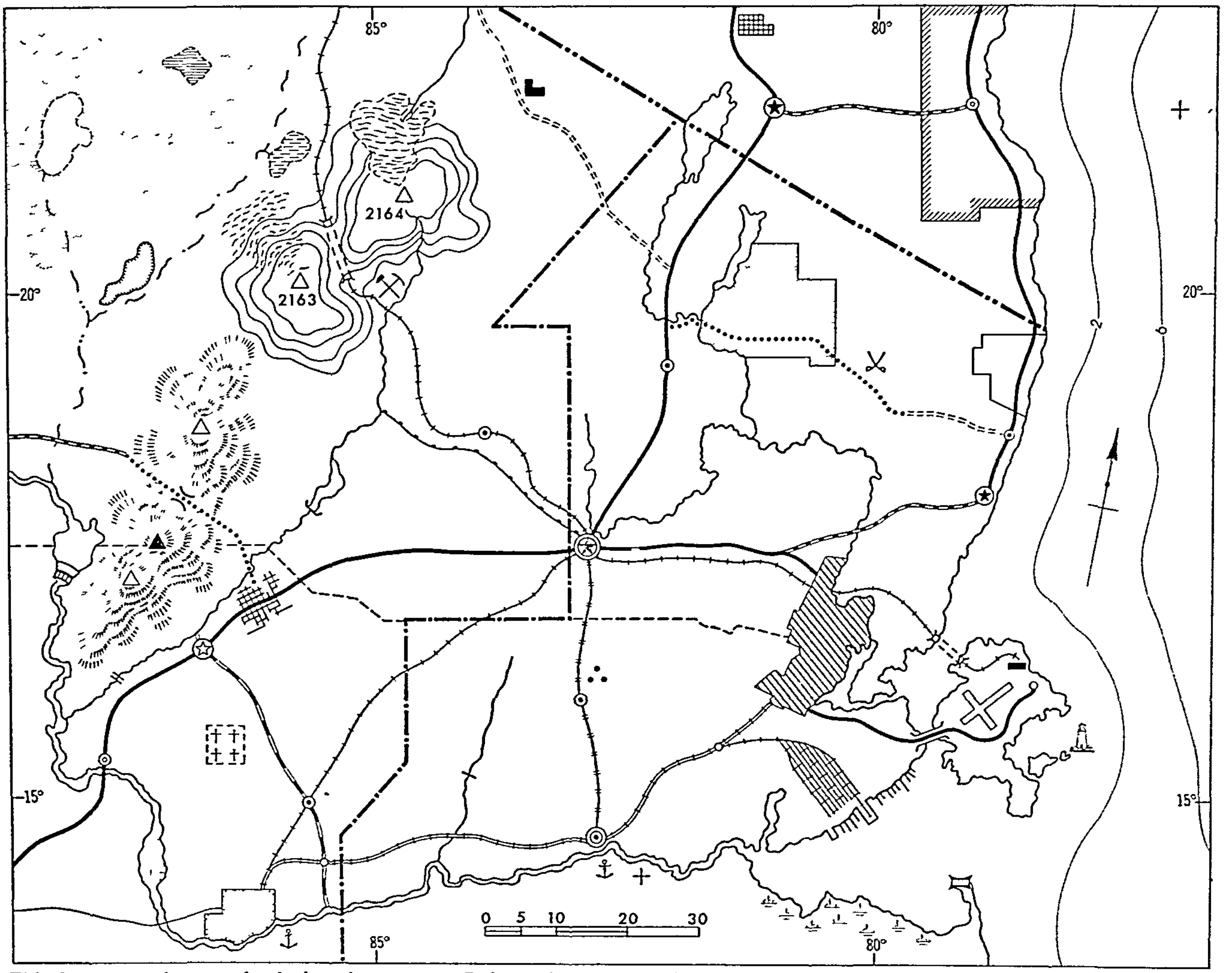
The choice of symbols may vary widely from map to map. One reason for this variance lies in the size of the map and the area it covers. A large map of a small area has room for many symbols or for the larger and more pictorial symbols. A small-scale map can use only points or small circles alongside the geographical names.

Another reason for variance lies in the general design and purpose of the map. Map makers choose the symbols that make the map both informative and easy to read. Thus even within the same publication, an atlas or an encyclopedia, the choice of symbols may vary from map to map. Within the same map, however, symbols are used consistently. Special symbols and conventions are often explained in a key in one corner of the map.

A physical, or topographic, map shows land (*hypsographic*) and water (*hydrographic*) features. As explained previously in this article, the rise and fall of the land may be shown by hachures or by plastic shading. The plastic shading may show height by color on multicolored maps. Mountains or high points are shown by triangles. Most bodies of water are shown as solid tones; on multicolored maps they are usually blue. Different kinds of lakes may be shown by the symbols in the table on this page. Such special features as deserts, glaciers, and lava beds have distinctive symbols. Dams, canals, and other man-made changes associated with natural features may also be shown on a physical map. Good examples of physical maps are the regional maps in the United States article in this encyclopedia. With each of these is a *locater* map, showing the location of the region with regard to the whole United States.

A political map emphasizes cultural and political features. The main natural features—continental out-

A MAP OF "NO MAN'S LAND"



This is a map of a completely imaginary area. It is made to show how all the conventions and symbols included in the table on the facing page would look on a map. It is possible, but highly improbable, that all these physical and political features would actually exist in one such area. An interesting game or school assignment is to find and identify all the symbols and conventions shown. Are there any other possible features that might be included? Where could they be placed on this map?

lines, lakes, and rivers, are shown for orientation; but the greatest prominence is given to inhabited places, political boundaries (international, state, and smaller divisions), highways and railroads, and places of historical or tourist interest. The color maps in the various state articles in this encyclopedia are good examples of political maps.

As the table on the opposite page shows, cities may be indicated in one of several ways. One way is by a series of graduated circles, suggesting relative sizes of areas and populations. Another way is to use a geometric shape to suggest the area and boundaries of the city. Still another is a series of crisscrossed lines without perimeter to suggest the density of building and the extent of the metropolitan area. The varying sizes and styles of lettering on the map may also be a key to the relative sizes and importance of cities and other places.

On a multicolored political map the different colors show political divisions easily. Railroads and steamship lines and air routes are often shown in red or some other prominent color. When international borders are in dispute, overlapping colors may be used instead of a definite boundary line.

Special-purpose maps may be in black and white or with additional colors. These are usually outline maps of a political division or a natural area, such as a continent, illustrating particular features about that region. Throughout this encyclopedia maps are used generously. Many of these are special-purpose maps to show one fact or related facts in an area. For example, the articles on the continents have maps showing annual precipitation, vegetation, heights and depths, and distribution of population. Product maps, locating production areas clearly, are also a feature of many articles. The articles on Lumber, Migration of Animals, Weather, and many others include special-purpose maps which explain the how, where, and why of their stories.

MARAT (*mȧ-rȧ'*), JEAN PAUL (1743–1793). One of the most radical supporters of the French Revolution of 1789 was Dr. Marat. He was born in Switzerland and studied medicine in France. Before the Revolution he was a successful physician. In 1786 he gave

CUTTING THE MARBLE FROM ITS ANCIENT BED

This is one of the New England quarries that supply much of the marble for our buildings and statues. Quarrymen cut the stone in large blocks. They lift them from the quarry with electric cranes and guy derricks onto railway cars to be hauled away.

up his practice and turned to journalism. In his paper *The Friend of the People*, founded in 1789, he attacked everyone in power and denounced both the aristocrats and the bourgeoisie, or middle class. Even the leaders of the Revolution feared him. At times he had to flee to England or hide in cellars and sewers. His writings influenced the masses and did much to bring about the cruel Reign of Terror.

Marat contracted a skin disease. He usually wrote his articles in a bath with a board across the tub because the warm water eased the pain. One day while he was in his bath, his servant announced that a young woman, Charlotte Corday, had a message to deliver to him personally. As Marat noted down her facts, she drew a knife and stabbed him in the heart. She had lived quietly with her aunt in Normandy, but when she had heard of Marat as a tyrant, she had gone to Paris to assassinate him. A revolutionary tribunal sentenced her to death and she went to the guillotine calmly. Marat was buried with pomp because the masses regarded him as a martyr. (*See also* French Revolution.)

MARATHON. On the little plain of Marathon, in Greece, about 25 miles northeast of Athens, may be seen a great mound nearly 50 feet high. Beneath it lie the remains of 192 gallant Athenians who gave their lives in 490 B.C. to preserve all Greece from conquest by the Persian hordes of Darius the Great (*see* Persian Wars). The mound raised by their fellow citizens to commemorate their heroism was excavated in 1890, and the sacred relics were brought to light.

The runner Pheidippides brought news of the victory to Athens and died shouting, "Rejoice! We conquer!" From Marathon to Athens is a distance of 26 miles and 385 yards. To honor Pheidippides the famous "Marathon race" was instituted in the modern Olympic Games held at Athens in 1896 (*see* Olympic Games). The term has since been applied to other long-distance races.

MARBLE. Sculptors and architects for centuries have used the beautiful and strong stone called marble. Strange as it seems, its beauty and strength come from the skeletons and shells of countless millions of tiny sea animals, or crustaceans.

Ages ago, their mineral remains, made up of calcium carbonate, sank to the bottom of the sea. Mud and other sediments covered them and pressed them into limestone (*see* Limestone). Water, heat, and pressure then metamorphosed, or changed, the rock into marble (*see* Rock; Geology). As marble it is more compact and crystalline. Some marble metamorphosed from dolomite, composed of calcium magnesium carbonate.

Onyx marbles did not metamorphose from limestone, but are calcium carbonate deposited by water. Verd antiques are marbles, usually green in color, chiefly made up of serpentine, a hydrous magnesium silicate. Commercially, any rock containing calcium carbonate that can be polished is called marble.

Pure marble is white. However, marble varies widely in color, from white to black through almost every shade of the spectrum. Impurities such as silica, iron oxides, and graphite give it its color and characteristic rich veining and clouding. In texture it ranges from fine to coarse and takes a good polish.

Marble is easily carved for statues. Impervious to moisture and fire resistant, it is ideal for monuments and fireproof buildings. Architects use it for columns, walls, floors, and steps, both interior and

exterior. Interior decorators use it for table tops, fireplaces, radiator covers, and many other purposes.

The ancient Greeks used Parian marble from the Island of Paros for such famous statues as the 'Venus de Medici'. They built the Parthenon of Pentelic marble from Mount Pentelicus. Marble from Carrara, Italy, used by the Romans and such Renaissance sculptors as Michelangelo, is still quarried today.

Marble is found in many parts of the world. American importers have a selection of about 100 types from Italy, France, Spain, Belgium, Morocco, Portugal, and other countries. The United States produces about 120 types of marble. Vermont, Tennessee, and Georgia lead in quarrying marble as dimension stone for buildings and monuments. Missouri, Arkansas, Maryland, Colorado, Minnesota, Alabama, and North Carolina are also producers. Many states quarry marble as crushed or broken stone for terrazzo flooring, roads, concrete aggregate, and other uses. (*See also* Quarrying.)

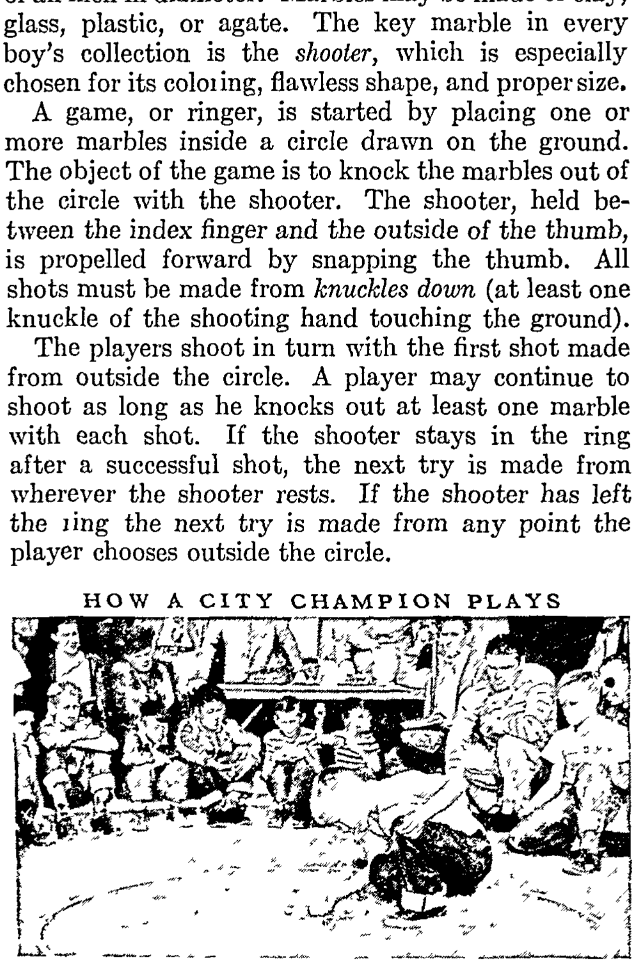
MARBLES. One of the oldest games in the world is marbles. Since ancient times boys have gathered outdoors in the spring to "shoot" a game of marbles. They give the sport all the study and practice that their elders devote to golf or bowling.

The game is played with colored balls about $\frac{5}{8}$ of an inch in diameter. Marbles may be made of clay, glass, plastic, or agate. The key marble in every boy's collection is the *shooter*, which is especially chosen for its coloring, flawless shape, and proper size.

A game, or ringer, is started by placing one or more marbles inside a circle drawn on the ground. The object of the game is to knock the marbles out of the circle with the shooter. The shooter, held between the index finger and the outside of the thumb, is propelled forward by snapping the thumb. All shots must be made from *knuckles down* (at least one knuckle of the shooting hand touching the ground).

The players shoot in turn with the first shot made from outside the circle. A player may continue to shoot as long as he knocks out at least one marble with each shot. If the shooter stays in the ring after a successful shot, the next try is made from wherever the shooter rests. If the shooter has left the ring the next try is made from any point the player chooses outside the circle.

HOW A CITY CHAMPION PLAYS



Admirers and players watch intently as an eight-year-old marble champion takes careful aim for his next shot.

If the game is played *for fair*, the winner is the one who shoots the most marbles out of the circle. In a game *for keeps*, each player is allowed to keep all the marbles he has won. Tournament games are played for fair with 13 marbles. They are placed in the form of a cross inside a circle that measures ten feet across. Each year a national tournament for local champions is held at Asbury Park, N. J.

MARCH. Before January and February were introduced into the calendar the Roman year had only ten months, and March, named in honor of the god Mars, was the first instead of the third month. In the Middle Ages the year was usually reckoned as beginning March 25, and England did not abandon this practice until 1752. The last three days of March were once supposed to have been borrowed from April, and according to an old proverb they are always stormy. The vernal equinox (*see* Equinox and Solstice) falls about March 21, so the month is part winter and part spring. According to the old saying, if it "comes in like a lion it will go out like a lamb."

MARCONI, GUGLIELMO (1874–1937). The man who turned a laboratory experiment into the practical invention of radio was Guglielmo Marconi. The Italian scientist and inventor was born April 25, 1874, on a family estate near Bologna. He was the son of an Italian businessman and a Scotch-Irish mother. Tall, fair-skinned, and blue-eyed, he was British in appearance but Italian in manner.

Even as a small boy he was keenly interested in science. His parents wanted him to be a musician and he did, in fact, become an accomplished pianist. His greatest interest, however, lay in physics, chemistry, and especially in electricity. The boy was privately tutored and received his scientific education from professors of the University of Bologna.

In 1894 young Marconi read an obituary of Heinrich Hertz, the discoverer of Hertzian waves—what we now know as radio waves. The young man's imagination was stirred by the account given of Hertz's work and the idea occurred to him that Hertzian waves might be used in communication. He set to work on apparatus for sending and receiving telegraph messages through the air and soon was able to transmit signals more than a mile. Marconi offered his invention to the Italian government, but they rejected it. In 1896 he went to England and took out a patent, the first ever granted for a practical system of wireless telegraphy. The next year a company was formed, later known as Marconi's Wireless Telegraph Company, Ltd., to exploit wireless commercially. Originally owner of half the capital stock in this venture, Marconi became wealthy through the success of his company.

One of the first practical applications of wireless came in 1898, when Marconi followed the Kingstown Regatta in a tug and flashed the results to the offices of a Dublin newspaper. In the same year a set was installed in the Prince of Wales's yacht where the prince was recovering from a leg injury. Queen Victoria was kept informed of his progress by wireless. In 1899 the importance of wireless in saving

GUGLIELMO MARCONI

Marquis and senator of Italy, Nobel prize winner, and recipient of many medals, Marconi was perhaps more highly honored in his lifetime than any other inventor.

lives at sea was first demonstrated. The East Goodwin Sands lightship was rammed in a fog and aid was summoned by wireless. In later years, passengers of the sinking *Republic* were rescued by ships signaled by wireless, as were survivors of the *Titanic*.

In 1901 Marconi achieved a dramatic success when he spanned the Atlantic Ocean by wireless. Other scientists had thought this impossible, holding that radio waves traveled only in straight lines. Marconi, however, felt that the long waves he used would follow the curvature of the earth. This was proved when, on Dec. 12, 1901, he received signals in St. John's, Newfoundland, sent from a transmitter in Poldhu at the southwestern tip of England.

By constant work, Marconi continued to improve his basic devices, sending messages farther and farther. In 1910 he was able to receive signals at Buenos Aires, Argentina, from Clifden, Ireland, and in 1918 he sent a message from England to Australia. Other scientists added their inventions, such as the vacuum-tube amplifier and the audion tube (*see* Radio). By 1921 Marconi's wireless telegraphy had become wireless telephony, the voice radio of today.

As long-wave broadcasting neared perfection, Marconi turned his attention to short waves. By 1922 he had perfected *beam transmission* of short waves, focusing the waves with a parabolic reflector behind the antenna. This system is employed now by most world-wide communication systems. Among his many useful inventions was the *radio direction finder* (RDF) by which ships and airplanes can fix their positions by radio signals. In 1934 Marconi demonstrated equipment that made instrument navigation of ships possible. Another of his inventions, the autoalarm, picks up distress signals when radio operators are off duty and sounds a loud alarm. He was also a pioneer in the use of ultrahigh frequency (UHF) waves for voice radio communication over short distances.

Marconi (with Karl Ferdinand Braun) was awarded the Nobel prize in physics for 1909. He was named to the Italian senate in 1914 and in 1929 he was created a *marchese* (marquis). An automobile accident cost Marconi his right eye in 1912, but he did not let this handicap interfere with his work or with yachting and motoring.

Marconi was married twice. In 1905 he married Beatrice O'Brien, daughter of an Irish peer. They had two daughters and one son. This marriage was dissolved by a court decision, confirmed by the Vatican in 1927. In the same year he married Countess Maria Cristina Bezzi-Scali, who bore him one daughter. Politically he was a Fascist by conviction, and until his death on July 20, 1937, he had charge of scientific research under Benito Mussolini.

MARCUS AURELIUS ANTONINUS, ROMAN EMPEROR (A.D. 121–180). In the second century of the Christian Era, the peace and happiness of the Western World depended largely upon whoever happened to be emperor of Rome. When Marcus Aurelius became emperor in A.D. 161, he faced an appalling task. Generations of luxury had made the patricians weak and selfish. The middle class was disappearing and the working class was being reduced to slavery. Germanic tribes were pressing at the borders, and few Romans seemed willing to fight for their homeland.

Marcus had been marked for this task almost from birth. It was usual at that time for Roman emperors who lacked sons to adopt relatives as their successors and tutor them in imperial duties. Marcus was adopted and educated by his uncle, who became the emperor Antoninus Pius. When Antoninus died, Marcus succeeded him. Marcus Aurelius had been trained in the Greek Stoic philosophy, and he followed it throughout life. Although the wealth of the Mediterranean world was at his disposal, he chose to dress plainly, live frugally, and work from early morning to midnight. "Blot out vain pomp; quench appetite; keep reason under its own control," he counseled.

He placed the good of society before his own individual comfort. "What is not good for the swarm is not good for the bee," he wrote. He put good government into effect, limited the gladiatorial games, and passed laws benefiting slaves. This pagan emperor, by the nobility of his principles, attained something like the loftiness of Christianity; yet he persecuted the Christians for fear they would destroy the state. Though he loved peace, he was a good warrior and throughout his life succeeded in defending the border provinces against invasion. In his few spare moments he jotted down in Greek the rules that guided his own conduct. The resulting volume of 'Meditations' is one of the world's favorite books of wisdom.

Worn out by war and the burdens of state, he died in March of the year 180. He was the last of the "five good emperors," whose combined reigns marked the golden age of the Roman Empire (*see* Roman History).

MARIA THERESA (*tĕ-rē'-sa̤*) **OF AUSTRIA** (born 1717, ruled 1740–80). At the age of 23, beautiful Maria Theresa was proclaimed archduchess of Austria and queen of Bohemia and Hungary. She also inherited outlying possessions of the house of Austria in Italy and in the Netherlands. Various powers hoped to add to their territories at the expense of the inexperienced queen. Most determined of all her enemies was young Frederick II, who became king of Prussia a few months before Maria Theresa came to the throne.

Maria Theresa's father, Emperor Charles VI, was the last of the direct male line of the Austrian Hapsburgs (*see* Hapsburg). He had no sons and the Hapsburg law forbade women to inherit Hapsburg lands. In order to secure his eldest daughter's succession, he drew up a revision of the law, called the Pragmatic Sanction. After long negotiations he persuaded all the important powers of Europe—including Prussia—to agree to this international treaty. As soon as Charles VI died, however, Frederick made plans to enlarge his small kingdom at Maria Theresa's expense.

Before coming to the throne, Maria Theresa married Duke Francis of Lorraine; but she never allowed her husband to forget that she herself was the reigning monarch. At once she began to show an astonishing aptitude for government and a grasp of international politics. In war, however, she was no match for Frederick II, one of the greatest military commanders of all time.

Maria Theresa had been on the throne only two months when Frederick marched his army south into Silesia, the fertile valley of the Oder River, which stretched southeast from his own Brandenburg. Maria Theresa was not one to sit idly by while her lands were torn from her. Her Hungarian subjects came loyally to her aid but were unable to expel Frederick from Silesia.

Frederick's success encouraged other countries to treat the Pragmatic Sanction as a mere scrap of paper. Most of the powers of Europe joined in the War of the Austrian Succession (1740–48). Maria Theresa found an ally in George II of Great Britain, who, as elector of Hanover, a German state, feared the spread of Prussia's power. On the other side the main parties were Prussia, France, Spain, and Bavaria. On the high seas and in America the conflict raged between France and Great Britain as King George's War.

The treaty that ended the War of the Austrian Succession was signed at Aix-la-Chapelle in 1748. It confirmed the loss of Silesia to Prussia, but restored everything else to the situation at the opening of the war. Maria Theresa won recognition of the principle of the Pragmatic Sanction; and the powers approved the election of her husband (in 1745) as Holy Roman emperor with the title of Francis I.

Maria Theresa's pride and her devout Catholicism made her determined to recover her lost province from Protestant Prussia. She formed an alliance with Russia and then set about to win France from its 200 years' enmity to Austria. Frederick then entered into an alliance with Austria's former friend, Great Britain. Maria Theresa's able foreign minister Count Kaunitz concluded the French alliance in 1756. This disturbed all existing international arrangements. The "third Silesian war" broke out in the same year and merged into a war between England and France for empire in America and in India (*see* Seven Years' War). Frederick, beset by enemies from all sides, earned his title of "the Great." Russia concluded a peace with him and he then turned upon the Austrians and drove them out of Silesia (*see* Frederick the Great).

Maria Theresa more than made good the final loss of Silesia by joining with Russia and Prussia in the first partition of Poland (1772), Galicia falling to Austria's share (*see* Poland). The last important act of her reign was the Peace of Teschen (1779), which averted another war with Prussia.

Maria Theresa had 16 children. To strengthen the alliance with France, she married her youngest daughter, Marie Antoinette, to the heir to the French throne (*see* Marie Antoinette). Her eldest son, Joseph II, assisted her in the government after the death of her husband. During her 40-year reign she carried out many reforms to promote prosperity and to strengthen the unity of her lands. She ruled as an absolute monarch, but she was one of the "enlightened despots" of the 18th century. When she died, Joseph II succeeded her and carried further many of the reforms she had begun. (*See also* Austria-Hungary.)

MARIE ANTOINETTE (*ăn-twŏ-nĕt'*), **QUEEN OF FRANCE** (1755–1793). It was the tragic fate of Marie Antoinette to be queen of France during the period of the French Revolution. Gay and light-hearted when her husband came to the throne, she ended her life on the guillotine. She probably never said "Let them eat cake" when a starving mob surrounded the palace and demanded bread; yet the legend has a small background of truth because she seemed to have little understanding of the wretched condition of the people.

Marie Antoinette was the daughter of Emperor Francis I and Maria Theresa of Austria. France and Austria, long bitter enemies, made a treaty of alliance (*see* Maria Theresa). To strengthen the alliance, it was arranged that Marie Antoinette should marry the dauphin (heir to the French throne). The marriage took place in 1770. Marie Antoinette was 15 years old and the dauphin was 16.

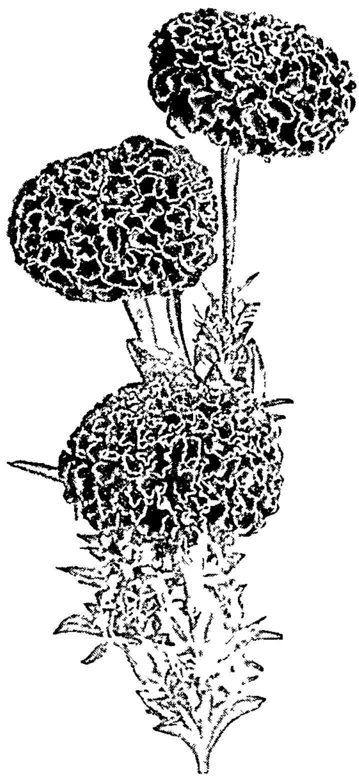
The dauphin was well intentioned but dull and unsociable. His chief interests were hunting and making locks in his workshop. His beautiful and vivacious young wife went her own way, bent on pleasure, and shocked the French court by disregarding its strict etiquette. In 1774 Louis XV died and the dauphin be-

came king as Louis XVI. The country was almost bankrupt; but extravagance continued to be the rule at the palace of Versailles. Gradually the Revolution gathered force. The public blamed much of their distress on the queen, whom they contemptuously called "the Austrian."

On Oct. 5, 1789, several thousand women and a number of armed men trudged the 12 miles from Paris to Versailles and demanded that the king give them bread. In the morning they took the royal family back with them to Paris and installed them in the Palace of the Tuileries. Marie Antoinette finally persuaded the king to flee with her. On the night of June 20, 1791, dressed as ordinary travelers, the family left by coach for the eastern border. Before they reached it, they were recognized and forced to return to Paris. This incident strengthened the popular suspicion that the king and queen were plotting to bring about foreign intervention.

On Aug. 10, 1792, revolutionists stormed the Tuileries and massacred the Swiss Guards. The royal family was imprisoned. On September 22 France was proclaimed a republic. Louis XVI was beheaded on Jan. 21, 1793. The queen remained in prison; and though saddened by separation from her son seven months later, she showed remarkable fortitude. On Oct. 14, 1793, during the Reign of Terror, she was brought to trial and condemned for treason. Two days later she was put to death on the guillotine. (*See also* French Revolution; Louis XVI.)

GARDEN MARIGOLDS



The flower of each marigold is a composite of hundreds of florets, or small flowers. They bloom all summer.

MARIGOLD. From midsummer to frost marigolds bloom in profusion in our gardens. The flowers range in size from half an inch to four inches across. They are named for the Virgin Mary—"Mary's gold."

Although they are natives of Mexico, the common annuals are called French and African marigolds. The French marigold (*Tagetes patula*) is a bushy plant about a foot high which spreads its lower branches close to the ground. The flowers are small, usually golden yellow with red markings. The African marigold (*Tagetes erecta*) grows to a height of two or three feet. Its flowers are usually solid in color, from pale yellow to deep orange. This is the common marigold of old-fashioned gardens. The leaves have a strong, pungent smell. The sweet-scented marigold (*Tagetes lucida*) is perennial in warm climates, where it grows to form a bush five feet high, bearing dense clusters of small yellow flowers.

The pot marigold (*Calendula officinalis*) belongs to a different genus. It is a calendula, a branching annual that is native to Mediterranean regions. The calendula takes its name from the calendar because in warm countries it blooms most of the year. It grows two feet high and it has large showy, flat flowers, pale yellow to deep orange in color. The flowers open and shut with the sun. The thick leaves and stem are sticky and hairy. The leaves were formerly used as a flavoring for soups. (*See also* Marsh Marigold.)

The SEA SOLDIERS *of the* UNITED STATES

MARINE CORPS, UNITED STATES. Since the early days of the Revolutionary War the United States has had a proud group of fighting men trained for war on land and at sea. This organization is the Marine Corps, a self-contained combat force within the Naval Establishment of the United States.

The Marine Corps is a special body of amphibious troops equipped with all necessary supporting arms —aircraft (including helicopters), artillery, and engineers. Its primary mission is to provide ground forces in support of naval campaigns. This mission usually takes the form of assaulting an enemy-held beach from special landing craft. Once ashore, the marines fight as infantry to seize and hold the objective—generally a naval base or an air field. In such operations marines are under the overall direction of a fleet commander.

In addition to supporting the fleet the Marine Corps carries out several other important duties. Marine detachments serve on large warships such as cruisers, aircraft carriers, and battleships. In time of peace, marines provide garrisons to protect naval yards and other shore establishments. During emergencies, however, such guard duties are usually taken over by the naval civilian police. Abroad, marines are stationed at embassies and legations in order to protect American interests and lives in time of danger.

Organization of the Marine Corps

The Corps is directed by a four-star general commandant who takes his orders from the secretary of the navy. The chief component of the Corps is the Fleet Marine Force, which is divided into two major commands—the Pacific, with headquarters at Pearl Harbor, Hawaii; and the Atlantic, with headquarters at Norfolk, Va.

Marine officers hold ranks similar to those in the Army, from four-star general to second lieutenant. Officers receive promotions on a merit basis after

serving three years in grade. Enlisted men are divided into seven pay grades—master sergeant, technical sergeant, staff sergeant, sergeant, corporal, private 1st class, and private. There are also four grades of warrant officer. (For table of base pay, *see* Army.)

Applicants for the Marine Corps must be between the ages of 17 and 28 and in excellent condition to be eligible for first enlistment. Terms of enlistment are three or four years, although this period may be extended sometimes. Recruits living east of the Mississippi River are sent to Parris Island, S. C., for training; those west of the Mississippi, to San Diego, Calif.

The nature of the marines' service requires versatility and self-reliance for they often operate in small groups commanded by noncommissioned or company grade (lower ranks) officers. Marines, therefore, frequently must use their own judgment and initiative in discharging their duties.

Marine Reserves and Symbols

An important part of the Marine Corps is the reserve organization created by law in 1914. During the Korean war almost every member of the active reserve was called to duty. The reserve now consists of three divisions—ready (organized), standby (volunteer), and retired.

The Women's Reserve United States Marine Corps was established in 1943. Its members performed many duties in the United States, Hawaii, and Europe to release men for combat service. Since 1948 women have been accepted as regular members of the Corps. Applicants must be between 18 and 31 years of age and unmarried. Recruits receive their training at Parris Island. The officer training course is given at Quantico, Va., for specially qualified candidates. There are about 2,500 women marines.

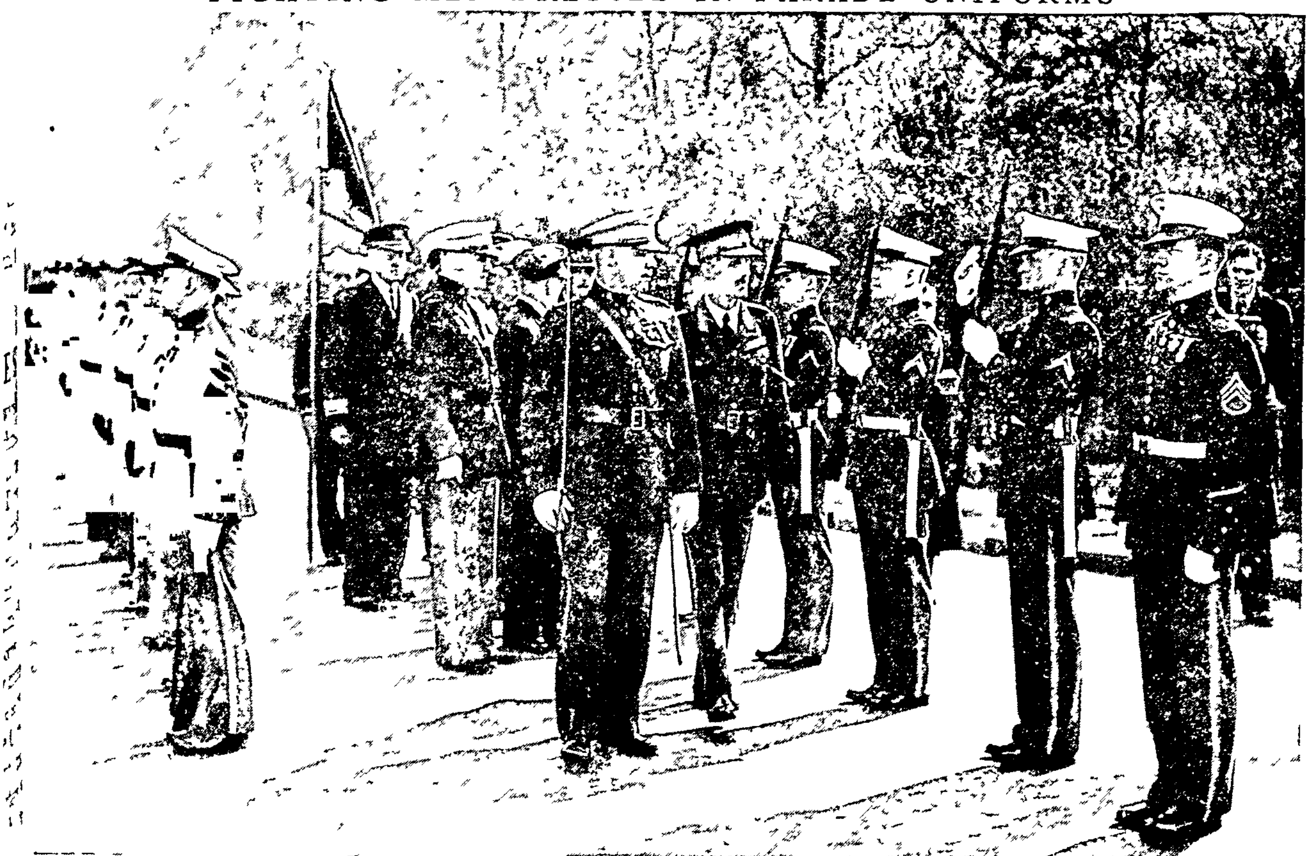
The motto of the Marine Corps is *Semper Fidelis* (Always Faithful). The nickname, "Leathernecks," originated from the black leather stocks they formerly wore to protect their throats against sabers and cutlasses. A globe, eagle, and anchor are combined in the emblem of the Corps. It is worn on caps and collars and emblazoned on the standards of the Corps. (*See also* Flags; Uniforms.)

Many historic relics and souvenirs of the Corps are housed in the Marine Corps Museum in Quantico, Va. One of its proudest possessions is the American flag that marines raised atop Mount Suribachi on Iwo Jima during the second World War.

Marines' Long History of Combat

The present Marine Corps is descended from two battalions authorized by the Continental Congress on Nov. 10, 1775. Captain Samuel Nicholas, the first marine commissioned officer, recruited many of this group in the historic Tun Tavern near Philadelphia. The first marines sailed with the new fleet under

FIGHTING MEN DRESSED IN PARADE UNIFORMS



A detachment of marines stands at rigid attention during an inspection by a British marine general in London. Each marine comes to a smart "inspection arms" position with his rifle as the inspecting party comes abreast of him. The marine uniform worn here is "undress" blues—dark blue blouse and light blue trousers. Both garments are trimmed in red piping.

Commodore Esek Hopkins in 1776 and stormed British forts on New Providence in the Bahamas. Here they captured 600 barrels of gunpowder desperately needed by the colonial army.

On Christmas night in 1776 they supported George Washington when he crossed the Delaware River and surprised the Hessians in New Jersey. In the naval battles of the Revolution they fought on the decks of the frigate *Constitution* (Old Ironsides) and on John Paul Jones's *Bonhomme Richard.*

In 1805 marines crossed the Sahara afoot and camelback to crush the Mediterranean pirates at Tripoli. Over Derne they hoisted the Stars and Stripes, the first time the American flag was flown over a fortress in the Old World. During the War of 1812 they fought in the battles on Lake Erie and Lake Champlain and with Andrew Jackson at New Orleans. They cleared the Caribbean of pirates in 1821 and battled Creek and Seminole Indians in Georgia and Florida, 1836–37.

During the Mexican War marines helped capture the fortress of Chapultepec in 1847. They sailed with Commodore Matthew C. Perry when he opened Japan to trade in 1854. Under the command of Col. Robert E. Lee they seized John Brown at Harpers Ferry in 1859. Marines fought throughout the Civil War on land and at sea. In the years that followed they performed valuable services in many parts of the world—China, Korea, Samoa, Fiji Islands, Egypt, in South and Central America, and in Cuba.

During the first World War the Fourth Marine Brigade shattered the German forces at Belleau Wood (*see* Belleau Wood). They also fought at Soissons, St. Mihiel, Champaigne, and the Meuse-Argonne.

"THE MARINES HAVE LANDED"

In the second World War the first American counterattack in the Pacific was at Guadalcanal. Here the 1st Marine Division makes the initial assault on the island from landing craft. Marines are specially trained for such amphibious operations

Second World War and Korea

The list of marine engagements in the second World War is almost the history of the Pacific campaign. They fought at Wake Island, the Solomons, Tarawa, the Marianas. Peleliu, Iwo Jima, and Okinawa. The campaign on Iwo Jima cost the marines about 20,000 casualties, the greatest number in their history. In this engagement a marine corporal, 17-year-old Jack[illegible], became the youngest warrior ever to win the Congressional Medal of Honor.

During the war the Marine Corps enlisted a total of 589,852 officers and men, the highest number in its history. Most of this group served with the Fleet Marine Force, which was divided into six combat divisions. After the war the strength of the marines was set at 108,000 officers and enlisted men.

When the war in Korea broke out, however, the Corps was enlarged and the 1st Marine Division was landed to fight alongside other troops of the United States and the United Nations. During the three years of fighting in Korea the division received two Presidential Unit Citations, for the Inchon landing and for the withdrawal from the Chosin Reservoir area, both in 1950. These awards were added to the three presidential citations given the division during the second World War—for the Guadalcanal, Peleliu, and Okinawa campaigns.

In 1952 Congress authorized a minimum Marine Corps of three divisions plus three air wings. It also set a ceiling of 400,000 enlisted men in peacetime. The actual size is to be determined by specific appropriations instead of being a percentage of the Navy strength as it formerly was. In addition, the commandant of the Corps was given coequal status with the other Joint Chiefs of Staff where marine interests are concerned.

Marines of Other Countries

The first seagoing soldiers sailed on King Solomon's galleys almost a thousand years before the birth of Christ. They served also on the warships of the Egyptians, the Carthaginians, and the ancient Greeks. In those days the marines were the only ones who fought: the sailors and the slaves on the rowers' benches did nothing but handle the ships. On the sail-driven galleons of Spain and Portugal in the 14th and 15th centuries, sailors were fighters too, but marines formed spearheads for boarding and landing parties. When gunpowder came into use in naval warfare, marines became the sharpshooters who climbed into the ship's rigging and fired on the enemy sailors as they worked their guns. In 1664 Great Britain authorized

MARINE TEAMWORK IN KOREA

In battle the marine air arm gives close support to ground units. Here a Corsair plane zooms through a smoke cloud caused by burning napalm dropped on Communist positions.

the organization of a marine corps to operate with its fleet, and in 1740 they recruited two marine regiments in the American Colonies.

The United States and British military services are the only ones in which the marines are a separate, specialized force organized to act with the Navy. Other countries sometimes designate as "marines" their coast defense soldiers and those who garrison forts and colonies.

The Marines' Famous Hymn

The marines' pride in their achievements is summarized in 'The Marines' Hymn':

From the halls of Montezuma
To the shores of Tripoli,
We fight our country's battles
In the air, on land and sea.
First to fight for right and freedom
And to keep our honor clean;
We are proud to claim the title of
United States Marine.

Our Flag's unfurled to every breeze
From dawn to setting sun;
We have fought in every clime and place
Where we could take a gun;
In the snow of far-off northern lands
And in sunny tropic scenes,
You will find us always on the job—
The United States Marines.

Here's health to you and to our corps
Which we are proud to serve;
In many a strife we've fought for life
And never lost our nerve;
If the Army and the Navy
Ever look on heaven's scenes,
They will find the streets are guarded by
United States Marines.

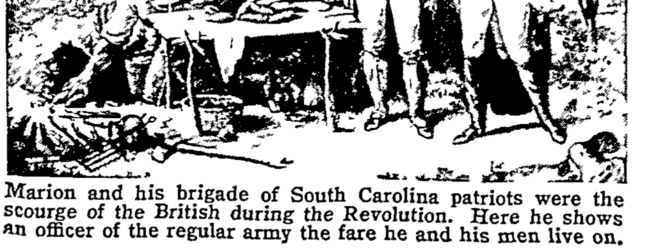
MARION, FRANCIS (1732?–1795). One of the boldest and most dashing figures of the Revolutionary War was the South Carolina rebel, Francis Marion. Again and again the British were prevented from subduing South Carolina because of the guerrilla warfare waged against them by Marion's men. The other famous partisan leaders in South Carolina were Thomas Sumter and Andrew Pickens, whose military skill helped save the state until Congress could send further help. The bands of all three leaders included patriotic farmers and backwoodsmen as well as professional soldiers.

Francis Marion was born in South Carolina, probably in St. John's Parish, Berkeley County, about 1732. His Huguenot grandfather, Benjamin Marion, had been exiled from France in 1690 because of his religion and had come to South Carolina.

When Francis Marion was about 27 years of age, he served in expeditions against the Cherokee Indians. In 1775 he was a member of the South Carolina provincial congress, and when this congress voted money for raising troops he was made a captain. In 1779, by then a lieutenant colonel, he led his regiment in an attack on Savannah, Ga. An injury kept him from being at Charleston, S. C., when that city was captured by the British in 1780. Later the same year he was on detached duty at the time of the disastrous battle of Camden and so did not take part in Gen. Horatio Gates's retreat.

Taking refuge in forest and swamp, he became the terror of the British in the section around Charleston. His force, known as "Marion's brigade," varied from a mere handful to several hundred men. When the enemy was least expecting it, the brigade would dash out, capture a detachment of British troops or rescue a band of American prisoners, and move swiftly back into hiding. As Col. Banastre Tarleton, the British commander, said, it was impossible to catch the old "swamp fox." Under this title Marion has become legendary for his military cunning. In the closing months of the South Carolina campaign, as

FRANCIS MARION, THE "SWAMP FOX"



Marion and his brigade of South Carolina patriots were the scourge of the British during the Revolution. Here he shows an officer of the regular army the fare he and his men live on.

brigadier general of the militia, he co-operated with Gen. Nathanael Greene to win final victory.

In 1781, before the close of the war, Marion was elected to the state senate and served several terms in later years. As a reward for his war service, the state legislature appointed him commander of Fort Johnson at a generous salary. He married his wealthy cousin Mary Esther Videau in 1786. His fellow citizens sent him to the state constitutional convention in 1790. He died Feb. 26, 1795, at his home in St. John's. Marion was a fine soldier and was admired by all who knew him, but part of the Marion legend probably derives from a romantic biography published in 1809. Its author was Mason L. Weems, the same "Parson Weems" who invented the cherry-tree story in connection with George Washington.

MARLBOROUGH (*môl'bŭ-rŭ*), DUKE OF (1650–1722). When John Churchill at the age of 15 became page of honor to the Duke of York (later King James II), he was known merely as a poor and ambitious lad of good family, handsome features, and polished manners. When he died, nearly 60 years later, he had been made Duke of Marlborough and was renowned throughout Europe as the greatest general of his age and one of its greatest statesmen.

Many things helped him in this phenomenal rise. The friendship of the Duke of York for his sister Arabella won for him his appointment as page to the duke and later, at the age of 17, a commission in the army. He learned the art of war while serving with England's French allies under the great Marshal Turenne in a war against the Dutch. His rise at court was further aided by his marriage at the age of 28 to the brilliant Sarah Jennings, the bosom friend of Princess Anne.

Churchill joined in the opposition to the catholicizing tendencies of James II, which cost that king his throne. At the critical moment when William of Orange landed in England, he deserted James's army and gave his support to the new king, William III. William never quite trusted Churchill because he had changed sides; but he rewarded him for his support by making him Earl of Marlborough and by giving him a command in a war against France in the Netherlands.

When Queen Anne came to the throne, in 1702, she showered favors upon Marlborough and his wife. These included the title of duke and the position of commander in chief of the English forces and the chief influence in the government. His abilities were equal to his opportunities. A Frenchman once said that "he never besieged a fortress that he did not take, never fought a battle that he did not win, and never carried on a negotiation that he did not bring to a successful close."

During the War of the Spanish Succession—in which England's chief interest was to prevent France from obtaining Spain, with its vast colonies and dependencies—Marlborough showed his unrivaled generalship in some of the greatest campaigns in English history. On Aug. 13, 1704, as commander of the Dutch and English forces, acting in harmony with Prince Eugene of Savoy, the Austrian commander, he won a great victory over the French at Blenheim on the Danube River. This battle stamped Marlborough as the first general in Europe. As a reward for this victory Marlborough was given the royal manor of Woodstock, near Oxford, and Blenheim Palace was erected for him on the grounds at government expense.

The battles of Ramillies in 1706, of Oudenarde in 1708, and of Malplaquet in 1709 continued Marlborough's career of victory. As a result England was able to negotiate the profitable Treaty of Utrecht in 1713, which ended the ambitions of Louis XIV and gave Europe peace for 30 years.

Marlborough had fallen from power before this treaty was negotiated. Queen Anne had at last tired of the tyranny of Duchess Sarah and found a new favorite. Marlborough's enemies succeeded in having him dismissed from power in 1711. He was even charged with embezzling public money, but was cleared. When George I came to the throne in 1714, after Anne's death, Marlborough was restored to favor. He died in 1722, and his remains now rest in the chapel of Blenheim Palace.

MARNE RIVER, FRANCE. The largest tributary of the Seine is the river Marne, 325 miles long. It flows generally westward across northern France and unites with the Seine at Charenton-le-Pont, an eastern suburb of Paris. Its broad valley forms one of the chief approaches to the French capital. This fact explains the part the Marne played in the first World War, when two important battles were named for the river.

The first battle of the Marne took place from Sept. 6 to Sept. 10, 1914. The Germans, following their swift drive through Belgium in August, had swept over France and had reached the outskirts of Paris. General Von Kluck, in command of the German right wing, was less than 20 miles from the capital. "Victory is ours!" was the message sent to Berlin.

Then, suddenly, the unforeseen happened. General Joffre, the French commander in chief, who had been doggedly retreating until the favorable opportunity to strike presented itself, sent out this message: "The hour has come to advance at all costs, and to die where you stand rather than give way." General Gallieni, the white-haired defender of Paris, loaded his troops into trucks, omnibuses, and taxicabs, and rushed them to the front to attack Von Kluck's right flank. At the same time, Generals Manoury, D'Esperey, and Foch, and the British under Sir John French, struck the overconfident Germans on the left flank and in the center. In a great four-day battle the Germans were driven back to the river Aisne, and the first great peril to France was over.

The second battle of the Marne took place in July 1918, nearly four years later. The Germans had launched a great offensive beginning March 21. By July 1 they had crossed the Marne River for the second time. Although they had been halted with the aid of United States troops in the battle of Château-

Thierry early in June (*see* Château-Thierry), they were still within striking distance of Paris.

On July 18, Foch, who had become commander in chief of all the Allied forces, threw American and French divisions against the Germans' north flank, which crumbled at the first stroke. This was followed immediately by another blow from the south, and on July 25 both banks of the Marne were cleared of the enemy. Then began the general German retreat, which with a few interruptions continued until the armistice. American divisions in this battle were the 1st, 2d, 3d, 4th, 26th, 28th, 32d, and 42d.

MARQUETTE (*mär-kĕt'*), JACQUES (1637–1675). Until the upper Mississippi River was discovered and explored by Father Jacques Marquette and Louis Joliet, this region was known to white men only through the reports of Indians. The long and dangerous journey these two men made will always be famous in the history of the New World. (*See also* Joliet.)

Jacques Marquette was born on June 1, 1637, to one of the oldest and most highly respected families of Laon, in northern France. At the age of 17, he decided to become a Jesuit priest and went to Nancy as a novice. After ordination he taught at Jesuit schools in northern France, always longing, however, to become a missionary overseas. In 1666 this wish was granted when his superiors sent him to Quebec in New France. There he studied the Indian languages and made many Christian converts among the Ottawa and Huron Indians. In 1671 hostile Sioux forced Marquette and his converts to quit the mission of La Pointe in the Apostle Islands of Lake Superior. Fleeing eastward, he founded the mission of St. Ignace, where the Straits of Mackinac connect the waters of Lake Michigan and Lake Huron.

There in the following year came Louis Joliet, a young fur trader and explorer whom Marquette already knew. Joliet carried a commission from the governor of New France to find and explore the "great river" to the south spoken of by the Indians. Marquette was to accompany him as a missionary to the Indians along the route. During the winter the two men made their plans. At last, on May 17, 1673, the straits were free of ice and the explorers could start out in their two bark canoes.

Paddling along the shore they entered Lake Michigan and safely traversed the choppy waters of Green Bay to the Fox River. Ascending the Fox to near its source, they portaged to the head of the Wisconsin River. Then for seven days they paddled their light canoes down the slow-moving Wisconsin. On the morning of the eighth day (June 17) the waters widened and the explorers swept their canoes into the current of the mighty Mississippi. Marquette and Joliet, with their crews, were the first white men to view the "Father of Waters" since De Soto's discovery of the lower river 130 years before.

The journey so far had been pleasant. The Indians they visited had been friendly and had listened eagerly to the words of the "Black-Robe." The remainder of the voyage, however, as they traveled hundreds of miles down the great stream, was not so easy. Marquette wrote in his report of the "monstrous fish" they came upon from time to time. The explorers looked with uneasiness upon hideous monsters painted high on the cliffs above the river. They were forced to use caution in approaching the unknown Indian tribes of the region. Usually, however, they were well received by the red men and were feasted on parched corn and roast dog meat. To all Marquette preached Christianity, and he gave his promise to the Illinois Indians that he would return to them within four months.

As Far as the Arkansas

At length on July 17, having gone almost as far south as the mouth of the Arkansas River, the explorers turned back. They feared capture by the Spaniards if they continued. They were now convinced that the river emptied into the Gulf of Mexico and not the Western Sea (Pacific), as they had hoped.

With difficulty they paddled back against the strong current of the Mississippi. When they reached the mouth of the Illinois River, they turned into it. Ascending the Illinois and the Des Plaines, they portaged over the low hills to the Chicago River and at its mouth entered Lake Michigan once more. In the last days of September they hauled their canoes out of the water at the little mission of St. Francis Xavier at De Pere near the head of Green Bay.

In less than five months, they had traveled more than 2,500 miles, a distance comparable to that covered by De Soto in the Southeast or by Coronado in the Southwest. The expedition proved fatal to the frail Jesuit father. He did return the next winter to the Illinois Indians as he had promised, but on his way back to the mission of St. Ignace illness forced him to halt. On May 18, 1675, he died in a hut in Michigan, near the mouth of the river now called in his honor, the Pere Marquette. Two years later some of his Indian friends carried his body back to his own mission at St. Ignace.

MARQUETTE AND JOLIET SEE THE MISSISSIPPI

White men saw the upper Mississippi River for the first time when the expedition of Marquette and Joliet reached the mouth of the Wisconsin River in 1673. Their long journey is a classic in New World history.

MARRIAGE—
The Most Important Contract in the World

MARRIAGE. For most young men and women the most important and happiest day of their lives is their wedding day. On that day, when the marriage ceremony makes them husband and wife, they start a new life—living together. They know they must adjust to one another to make their marriage a successful marriage; and that adjustments require thoughtfulness, co-operation, and sacrifices of some personal desires. Through the ages, however, people in all lands have found that these adjustments are very little to pay for the lifetime rewards of a happy marriage.

The United States has a higher percentage of married people than any other civilized nation. Over 90 per cent of American adults are married. The peak year for marriages was 1946, the first year after the end of the second World War, when there were 2,291,045 weddings. Now the average is about 1,600,000 marriages a year.

The legal age for marriage varies in the United States. With the consent of their parents, boys in some parts of the nation may marry at 14 years of age and girls at 12. Without consent, the youngest age is 18 years, except in Minnesota where girls may marry at 16 years. About half the American men are married by the age of 22.6 years; half the women by 20.4 years, with 90 per cent before 30 years.

In England for both sexes the youngest age for marriage is 16. In India, despite laws forbidding males to marry before 18 and females before 14, boys and girls in rural areas sometimes marry at nine or ten years. Mohammedan girls may marry at 12 years and boys at puberty (about 14 years). Under old Roman law the youngest age for boys was 14; girls, 12.

Banns and Requirements for Marriage

Some countries, such as England and Switzerland, require that *banns,* or public notices of a proposed marriage, be announced. The Roman Catholic church requires banns for its members in all nations.

In most civilized countries couples must get a *license* to marry. Couples may have to apply from one to five days in advance of issue date. In a few states there are waiting periods of 24 hours to five days after the license is issued. Most states require a blood test before granting a license.

Usually a couple must marry within a certain time after the license is issued. In England the maximum legal delay is three months, and no marriage may be performed after six o'clock in the evening. In the United States the permissible legal delay is usually not more than a month. About 2 per cent of marriage licenses issued in the United States are not used.

One of the strictest controls over the right to marry are the regulations on *kinship* and *affinity*—family relation by birth, marriage, or adoption. For centuries, nations have not permitted marriages of persons more closely related than first cousins. Many primitive tribes forbid the marriage of a widow or widower to close relatives of the dead mate.

Among some peoples and religions another barrier is *endogamy.* This forbids the marriage of two people who do not belong to the same tribe, race, social caste, or religion. Since 1908, however, the Roman Catholic church permits a Catholic to marry a non-

MARRIAGE CEREMONIES OF THE WEST AND THE EAST

In this unusual view, a Protestant minister presides at a formal wedding. The maid of honor and bridesmaids stand at the bride's left. The best man and ushers flank the bridegroom.

In this ceremony of the Russian branch of the Orthodox Eastern church, attendants hold crowns over the bride and groom. The crowns symbolize the honor and reward given by marriage.

Catholic when the ceremony is performed by a Catholic priest on church premises and the non-Catholic promises that all children will be reared in the Catholic faith. Most nations permit mixed religious marriage by a civil official or any minister.

By church or legal rule, a couple usually must be married before two or more witnesses. This prevents fraud or the use of force. Some nations and a few states in the United States recognize the *common-law* marriage, even without a license. For a common-law marriage a man and woman have only to agree that they are married as of a certain time. In marriage by *proxy*, an authorized person stands in place of the groom or bride. Generally, any marriage legal in one part of the world is accepted as legal in all others.

In Japan, India, and some other nations, marriages may be arranged by brokers. In the United States some people, usually immigrants, also use marriage brokers. A Jewish broker is a *schadchen*.

Wedding and Marriage Ceremonies

Wedding and marriage are not the same. The *wedding* is the ceremony that marks the beginning of a marriage. The basic element of *marriage* is the "consensus" in the marriage ceremony—that is, the mutual agreement of the two people to be married.

In 85 per cent of weddings in the United States the ceremony is religious and usually is performed in the church, the home of the bride, or the minister's home. The modern marriage ceremony includes betrothal, vows, and benediction. In the Roman Catholic church, marriage is a sacrament (matrimony).

The marriage ritual in the Orthodox Eastern church is elaborate. The actual ceremony takes 35 minutes. A dramatic moment is when the priest places crowns on the bride and groom. In the orthodox Jewish wedding, the bride is married under the *chuppah*, an ornamented wedding canopy. During the ceremony she and the groom face east. In a military wedding, the ushers, who are members of the armed forces, form an arch of swords for the recessional.

CUTTING THE BRIDAL CAKE

The groom helps cut the first slice of the bridal cake. The wedding cake is a smaller fruit or pound cake. Pieces are placed in boxes for the guests.

In most weddings the bride is given in marriage by her father or other male relative. The best man is an attendant to the groom. This custom may go back to ancient times when a friend accompanied the groom to help him capture the bride.

Until recent years, in most marriage ceremonies the bride promised to "obey" her husband. This pledge is now often changed to "cherish." In the Roman Catholic church the bride does not promise obedience, as it is expressed in the epistle of the nuptial Mass.

Wedding Customs Are Old and Varied

Most wedding customs are very old and come from many different lands. Throwing old shoes or tieing them to the bridal car goes back to ancient Egypt. There the father handed the bride's sandal to the groom, symbolizing a transfer of authority. The Saracens used orange blossoms in their ceremonies, as the orange was their most prolific fruit. Today orange

CATHOLIC WEDDING AND MILITARY RECESSIONAL

Here the best man, the groom, the bride, and her maid of honor kneel before the main altar while the Catholic priest celebrates the nuptial Mass. Two altar boys attend the celebrant.

Graduation day at West Point brings many weddings (right). Classmates form an arch of swords. The groom has his bride on his left, leaving his "sword arm" free as in days of chivalry.

blossoms symbolize a hope that the wedded couple will be blessed with children. Throwing rice carries the same wish; but in ancient times it was also a way to "protect" the marriage from evil gods.

Since the sun was a god to the Chocos and Hindus, they believed that if a bride-to-be gazed on the sun she would be certain to have children. This may explain the old saying, "Happy is the bride the sun shines on." Another widespread custom is for the bride to wear "something old, something new, something borrowed, and something blue." In ancient Israel the bride's robe had a blue border signifying purity, fidelity, and love.

The engagement ring represents the old custom of a gift to a girl desired in marriage. The diamond ring originated in Italy, where the diamond was believed to be a "flame of love." In hieroglyphics, the ring was a symbol of eternity.

WEDDINGS IN EUROPE AND ASIA

Left, musicians lead this bride and groom in Yugoslavia. Right, a Laos bride, center, and groom are being married in Indo-China. Here they are being linked by a cotton bracelet, symbolizing unity.

Even though her wedding day is her happiest day the bride is "supposed" to cry, symbolizing the dismay of the bride of old captured by force. The capture is also reflected in the custom of the groom carrying the bride over the threshold of their new home.

The bride's cake stems from ancient Rome, when it was made of salt, water, and flour. Today the bride's cake has elaborate decorations with white frosting. It may contain a ring, and the person who gets it is supposed to be the next one married. When there is a groom's cake (wedding cake) it is not eaten at the wedding. Small pieces are given to the guests. Sleeping on a piece is supposed to bring a dream to a single girl in which she will see her future husband.

Centuries ago in France the bride threw her garter, and the girl who caught it was believed to be the next bride. Today the bride throws her bouquet.

Wedding Anniversary Symbols

By tradition, married couples receive gifts made of certain materials on various anniversaries. The current list by anniversary is: 1st, paper; 2d, cotton; 3d, leather; 4th, fruits and flowers, or silk; 5th, wooden; 6th, iron, sugar, and candy; 7th, woolen or copper; 8th, bronze or pottery; 9th, willow or pottery; 10th, tin or aluminum; 11th, steel; 12th, silk or linen; 13th, lace; 14th, ivory; 15th, crystal; 20th, china; 25th, silver; 30th, pearl; 35th, coral or jade; 40th, ruby; 45th, sapphire; 50th, golden; 55th, emerald; 60th and 75th, diamond. The 25th, 50th, and 60th anniversaries are often called silver, golden, and diamond *wedding jubilees.*

Marriage Began in the Ancient Past

No one knows how marriage began. It may be as old as man and the family (*see* Family). It may have begun with *capture;* when a man wanted a wife, he seized a woman by force. As man became less primitive he may have exchanged food or livestock for a woman. In ancient times the man's family often provided presents for all the relatives of the girl. If the gifts were favorably received, the man would be given the woman he wanted. This giving of presents may be the origin of the marriage ceremony. Today, in Melanesia and many other primitive societies, families of both mates exchange gifts as pledges of friendship and union.

In ancient times the date of the wedding was often chosen at some phase of the moon when the gods were presumed to be favorable. This practice, with the custom of eating honey at the marriage feast, may be the origin of the word *honeymoon.*

Sometimes the marriage ceremony involved guarantees. The veil over the bride's face may have indicated that she had been secluded from men, and her white robe was a warrant of her purity. Even now it is thought bad luck for the groom to see the bride before the ceremony on their wedding day.

Festivals and Religious Rites

Ancient peoples celebrated marriage by festivals. The rituals often related to the fertility of the marriage or the warding off of evil spirits. The modern charivari, or belling and blowing car horns in the bridal party, may come from the ancient ceremonies designed to ward off the evil spirits.

Fear of the supernatural may have been the basis of early religious rites at the marriage ceremony. A magician or other religious representative nearly always took part in the marriage. When religion was formalized, both the religious and legal sanction of marriage was established. In most religious marriages today, God's favor is asked, accompanied by the injunction, "What therefore God hath joined together, let not man put asunder."

In many ceremonies in early times the man and woman pledged the rights and obligations of husband and wife by exchanging rings. The ancient Egyptians are thought to have been the first to use rings in marriage. The ring may symbolize the "captive bride," whose hands were tied to prevent her from escaping. The Anglo-Saxons wore the ring on the right hand until the wedding, when it was transferred to the left. As early as A.D. 860, Christians used wedding rings.

In ancient times, *betrothal* (engagement to marry) was a formal ceremony preceding the marriage service. Sometimes the period of betrothal was short; but in Australia and Melanesia infants were often betrothed. India permitted infant marriage, though years passed before the couple entered the marriage state. The betrothal ceremony is still found in some countries. It usually consists of exchanging rings, a kiss, or joining hands before witnesses.

Historic Three Stages of Marriage

Marriage has developed through three stages. At first it was simply mating. As this stage progressed the couple began to realize the obligation of having children. The second stage was legal, and the rights of each mate began to be defined. Customs and laws to regulate marriage were established. Property rights, the protection of children, rights of inheritance, interests of society, and the conditions of dissolving marriage were indicated. The third stage—the personal or moral stage of marriage—stresses ethical rights. The emphasis is on co-operation of husband and wife, the responsibilities and privileges of parenthood, and the relations of religion to marriage and family life.

Because marriage is controlled by custom, regulated by religion, and protected by law, it is called an *institution*. The family and marriage are the most important institutions in society.

The Disruption of Marriage

Marriages can be broken by death, desertion, divorce, or separation. A decree of separation does not entitle either of the couple to remarry. Desertion can become grounds for divorce after certain periods determined by various laws. "Informal desertions" occur in many underprivileged families, when a parent simply abandons a family. Desertions in the United States are estimated at 100,000 a year.

Divorce in some form is probably as old as marriage. Today some primitive people may signify divorce by merely breaking a rod publicly to indicate that the marriage is dissolved. Under the Moslem law, a man may obtain a divorce by repudiation, or *ṭalāq*. Pronouncing the ṭalāq three times, he repudiates his wife and gives up all the rights of his marriage. He usually states his reason. A wife may not divorce her husband by ṭalāq; she must apply to a court of law.

The Brahmans of India forbid divorce; but funeral rites may be held for a faithless wife. She is then an "outcaste" and regarded as dead. Widows cannot remarry. The Roman Catholic church forbids divorce but permits separation on certain grounds. If one spouse gets a civil divorce, the church forbids remarriage as long as the other lives. Separation, but not divorce, is possible in Argentina, Brazil, Chile, Colombia, and Paraguay. Other South American nations grant divorces. Canada has few, as the legal grounds are largely restricted to adultery.

Every state in the United States grants divorce. The grounds for divorce range from very limited to liberal. New York, for example, recognizes only one ground—adultery; Kentucky recognizes more than ten. Many people go to Nevada, Florida, or the Virgin Islands for divorce, because their residence requirements are unusually lenient.

Divorce Is a United States Problem

Just as the United States leads the civilized world in its percentage of marriage, so it leads in its percentage of divorce. Japan, Denmark, France, and Switzerland, the nations with the next highest percentages, are far behind it.

The divorce rate in the United States has increased spectacularly. The rate of 0.5 per 1,000 population in 1890 quadrupled to 2.0 in 1940. In 1946 the rate was a staggering 4.6 when 610,000 divorces were granted. By the year 1952 it had fallen somewhat.

About 70 per cent of childless marriages end in divorce, and about 40 per cent of all divorces occur in the first five years of marriage. The divorce rate is highest in the second and third years. A few more wives than husbands start actions for divorce. Many authorities believe that 40 per cent of all new and future marriages will be broken.

The divorce problem in the United States affects the entire community, because "broken homes" present the grave threat of instability. Divorce is a major social hazard when there are children in the family. A large percentage of retarded students, maladjusted boys and girls, "problem children," and juvenile delinquents come from broken homes. This is found to be true even among college students.

Preventive and Remedial Measures

There is, however, basis of hope for cutting down divorce in this country, because people prefer to remain married. Proof of this is that, age for age, the rate of remarriage of divorced persons exceeds the rate of first marriage for the single.

A relatively new service has grown from the realization that many divorces occur because the couple was not properly prepared for marriage. Now many schools and public and religious agencies instruct young unmarried people in the privileges and responsibilities of marriage. Other agencies and *marriage counselors* offer help to married couples in solving their problems.

In 1920 the Teachers College of Columbia University, New York City, opened the first course to acquaint students with marriage and family relationships. In 1926 the University of North Carolina began a course specifically designed to prepare senior students for marriage. Today some 1,300 colleges and universities give courses in preparing for marriage. About a third of the high schools give courses in mental hygiene, life adjustment, or personal relationships which include study of marriage and family life.

The Roman Catholic church gives engaged couples Pre-Cana conferences, named for the Biblical marriage at Cana, and Cana conferences for the married. Several Protestant denominations also sponsor programs. An American Association of Marriage Counselors was organized in 1945. Marriage counseling services spread throughout the world after the second World War, especially in Europe and Australia.

MARS. Next in importance to Jupiter in the Roman religion was Mars, the god of war. He was regarded as the father of the Romans, through his son Romulus, the legendary founder of the city, and was worshiped with great honor. He was in early times a god of nature and fertility, as well as of the vigor of war. Thus March (Latin *Martius*), the season when agriculture as well as warfare was resumed after the inactivity of winter, was dedicated to him and known by his name.

The Greek god Ares is identified with Mars. But the Greeks thought of Ares only as a sender of war and pestilence, a quarrelsome god, delighting in the slaughter of men and the destruction of cities. He was not widely worshiped in Greece, although the Areopagus, the sacred hill of Athens, was named from Ares.

OUR INTERESTING PLANET NEIGHBOR

This is part of a series of telescopic photographs of Mars, taken to study the changes in appearance due to rotation. These changes are too slight to be conspicuous here, but you can see the white spot of the Martian "polar region" very distinctly. The dark belt around the middle is supposed by some to be a vast region of dense vegetation about the planet's equator.

In astronomy the name Mars is given to the fourth planet in order from the sun, lying just beyond the earth—supposedly because of its red and angry countenance. (*See* Planets.)

MARSEILLES (*mar-sālz'*), FRANCE. The tang, the mystery, and the romance of the sea belong to Marseilles, the chief seaport and the second largest city of France. For more than 2,500 years, this city on the Mediterranean coast has been a port for vessels bringing people and cargoes from faraway lands. Southwest of the city lies the tiny island of Château d'If, scene of Dumas' story, 'The Count of Monte Cristo'.

From inland France products for export reach Marseilles by way of the Rhone River. Commerce by sea and canal gives the city a wealth of raw materials for manufacture. It has refineries for sugar, olive oil, and petroleum; mills for rice and oilseed; smelters for iron and copper ores; and factories that produce chemicals, soap, automobiles, and machinery.

The city sprawls among rolling hills. Much of the old section is dingy, but the newer part has wide streets and fine homes. Its bustling waterfront gives Marseilles a gusty atmosphere. Here in 1792 soldiers sang a new march so dashingly that under the name of 'The Marseillaise' it became the national song.

In 1944 Marseilles' famous water front and much of the rest of the city were damaged during the heavy fighting that preceded its fall to Allied troops who invaded southern France (*see* World War, Second).

Marseilles (in French, *Marseille*) was founded under the name Massalia by the Greeks about 600 B.C. It was Christianized in the 3d century, its first martyr being St. Victor, a Roman soldier put to death in the persecutions of Diocletian. In the Middle Ages, it was a port of departure for the Crusaders (*see* Crusades). In 1848, a 97-mile canal was completed, bringing from the Durance River a much-needed supply of fresh water. The opening of the Suez Canal in 1869 brought Asiatic trade to Marseilles and thus made the city grow rapidly. Population (1946 census), 551,640.

MARSHALL, GEORGE CATLETT (born 1880). As chief of staff of the United States Army throughout the second World War, General Marshall built up and commanded the greatest military force in history. Less than two years after the war ended, he entered upon a second important career, as secretary of state.

George Catlett Marshall was born at Uniontown, Pa., Dec. 31, 1880. He was the son of George Catlett Marshall, a coal-mine operator, and a great-grandnephew of Chief Justice John Marshall. He attended Virginia Military Institute, graduating in 1901. In 1908 he completed a course at the Army Staff College at Fort Leavenworth, Kan., and remained there two years more as instructor. He served twice in the Philippines (1902–3 and 1913–16). In 1917 he sailed for France as a captain on the general staff of the First Division and took part in the battles of Cantigny, the Aisne, the Marne, and St. Mihiel. General Pershing gave him high praise, in his memoirs, for planning the secret transfer of 600,000 troops to the Argonne front.

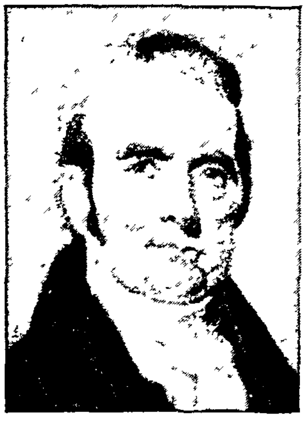
Appointed deputy chief of staff of the army in 1938, he became acting chief of staff in July 1939. In September, when Hitler's armies were smashing into Poland, he was appointed chief of staff of the army and his rank was raised from brigadier general to full general.

Marshall expanded the Army from 130,000 to 8,300,000 trained men; helped build up war industry to equip them; and ringed the world with supply lines. As a member of the Army and Navy Joint Chiefs of Staff and the Allies' Combined Chiefs of Staff, he played a leading role in planning campaigns in all parts of the globe. In 1944 he was raised to the newly created five-star rank of general of the army. He retired as chief of staff Nov. 21, 1945. Two weeks later President Truman sent him to China as temporary ambassador to try to bring an end to the Chinese civil war. He was recalled from this unsuccessful mission in January 1947 to succeed James F. Byrnes as secretary of state.

Marshall became head of the State Department at a time when the split between communist Russia and the democracies drove the United States into abandoning its traditional peacetime neutrality in

favor of an active role in the United Nations and in world affairs generally. In a historic address at Harvard University on June 5, 1947, he presented his Marshall Plan to restore the economic life of Europe and to check Communism. In 1948 this plan went into effect as the European Recovery Program. Marshall resigned as secretary in 1949; in 1950 he returned to the Cabinet as secretary of defense to combat Communist aggression in Korea. A year later, Sept. 12, 1951, he again resigned from the Cabinet and retired to his home at Leesburg, Va. (*see* Truman). In 1953 Marshall received the Nobel peace prize.

MARSHALL, JOHN (1755–1835). When John Jay, the first chief justice of the United States, resigned to become governor of New York, he said the Supreme Court could never attain proper influence. Less than 40 years later John Marshall, the fourth chief justice, declared he would rather be chief justice than president.



No other American did so much to reveal the great extent of the American judicial power or to teach his countrymen the true meaning of the Constitution. The decisions of the Supreme Court in the 34 years that Marshall was chief justice—especially during the earlier period—were bitterly criticized by the party of Thomas Jefferson. Today his reasonings and expositions of the law are accepted almost without dissent. He is now regarded as the greatest American jurist and one of the greatest in the history of any land.

Marshall's fame as chief justice has overshadowed his other services to the nation. Like Washington, Marshall was a Virginian. He was born in a log cabin on the frontier near Germantown, the first of 15 children. The boy loved the free life of frontier Virginia and enjoyed sports of all sorts. He had little formal education. At the age of 20 he left his study of the law to enlist in the Continental Army, in which he rose to be captain. He fought under Washington at Germantown and Monmouth and was in the daring attack of "Mad" Anthony Wayne at Stony Point. When the Revolution was over he returned to his law studies and was soon admitted to practice. Presently he won a big land-title case for Lord Fairfax' tenants against their landlord, and this brought him the leadership of the Virginia bar.

Already Marshall had been elected to the Virginia legislature, where he served for eight sessions. In the Virginia convention of 1788, he and James Madison won the battle for ratification of the Federal Constitution against the efforts of Patrick Henry and Richard Henry Lee. President Washington offered him first the post of attorney general and then that of minister to France, but Marshall declined both; for, as he said, his position in Virginia seemed "more independent and not less honorable than any other." He did accept an appointment from President John Adams as one of the three commissioners to France in 1797–98. A term in Congress followed, and then came a year's service as secretary of state in Adams' Cabinet. Finally, on Jan. 31, 1801, Marshall was appointed to the vacant chief-justiceship of the Supreme Court.

So persuasive was Marshall's personality and so sound and penetrating his reasoning that he soon won to his way of thinking the other members of the Supreme bench. In his first great case, that of Marbury *vs.* Madison, he declared it was the duty of the court to disregard any act of Congress—and hence of a state legislature—which it thought contrary to the Federal Constitution. Upon this decision rests the chief power of the Supreme Court today, that of declaring laws unconstitutional.

Equally far reaching was the decision in the case of McCulloch *vs.* Maryland (1819) in which the Hamiltonian idea of "implied powers" in the government was fully sustained. "Let the end be legitimate," said chief justice Marshall, "let it be within the scope of the Constitution, and all means which are appropriate, which are plainly adapted to that end, which are not prohibited, but consistent with the letter and spirit of the Constitution, are constitutional."

From this doctrine comes much of the authority which the government has over commerce, the militia, the acquisition of new territory, and the vast powers exercised in time of war. It means that the United States is a *nation,* with the powers appropriate to a nation, and not a mere weak confederation of practically independent states.

MARSH MARIGOLD. Early in April the bright yellow cups of the marsh marigold gild the wet borders of rivers and streams or huddle together on little islands in low swamps and marshes. These attractive saucer-shaped wild flowers are not true marigolds nor are they true cowslips, though they are often called by the name of those pretty English blossoms. They look very much like large buttercups, and it is to that family that they rightfully belong. They grow in great profusion from the Carolinas to Iowa, in the Rocky Mountains, and far northward. They are common in England, where they are often called kingcups. They are the "winking Mary-buds" of Shakespeare's poem in 'Cymbeline'. In the spring, when they are tender, the leaves may be boiled for "greens," and the flower buds preserved in vinegar and used like capers. (*See* Marigold.)

The marsh marigold belongs to the buttercup family *Ranunculaceae*. The scientific name is *Caltha palustris*. The flowers are 1 to 1½ inches across, with 5 to 9 glossy, oval, petallike sepals and numerous stamens and pistils. The stem is stout, furrowed, hollow, and branched near the top. The leaves are rounded, heart-shaped at the base, and growing either on long stems from the root or clasping the stalk where it branches.

AMERICAN PINE MARTEN

The American pine marten, or Canadian sable, lives in the woods of Canada and in the northern United States.

MARTEN. The Siberian sable marten is the most aristocratic member of this branch of the weasel family. It is the sole source of the famous and expensive fur called sable. An average skin of genuine Russian sable is worth several hundred dollars, and a coat of this lustrous fur costs many thousands. The outer guard hair of the sable is used for artists' brushes of the best quality. Each hair is evenly tapered, and so a sable brush comes to a fine point when dipped in water or paint.

Martens of various species are abundant in the northern portion of the Old and New Worlds. They have long slender bodies and short legs and live mostly in trees, leaping from one to another much like squirrels. Their outer fur is long and glossy.

In North America there are two species of marten, with a variety of local names. The American pine marten, or Canadian sable, similar to the pine marten of Europe, is about the size of the large house cat. It has a soft deep fur of rich brown, lighter colored below with a tawny spot on the throat; its fur is used as a substitute for Russian sable. It is fond of forests far from the habitation of man and shows special liking for pine trees. Its range is the northern woods, but even there it now is rare. It feeds upon birds and other animals. It multiplies rapidly, there being six to eight young to a litter.

The black marten, fisher, or pekan, as it is variously called, is the largest of the group, being from two to three feet long, with a bushy tail a foot or more in length. It has no immediate relatives in the Old World. In color it is grayish-brown, with dark markings, its tail tipped with black. It is bold, strong, aggressive, and a skillful hunter. It too belongs to the northern woods, occurs southward in the Alleghenies, and shows preference for regions of hemlock and spruce. The stone marten is another variety, with hair inclined to grayish-brown and pure white on the breast. It is found in most parts of Europe south of the Baltic.

The scientific name of the pine marten is *Mustela martes;* of the black marten, *Mustela pennanti;* of the Siberian sable marten, *Mustela zibellina;* and of the American pine marten, *Mustela americana.*

MARTINIQUE (*mär-t'n-ēk'*). Tourists who visit beautiful Martinique, one of France's small island possessions in the West Indies, find two spots of great historic interest. The first is the ruins of the quaint old house in which the unhappy Empress Josephine Napoleon's wife, was born. The other is the scene of desolation that marks the site of the once beautiful city of Saint Pierre, formerly the largest and most flourishing town on the island. It was totally destroyed on May 8, 1902, by an eruption of Mont Pelée. Molten lava, a shower of stones and ashes, and poisonous gases killed about 40,000 people.

Mont Pelée (4,428 feet) is the highest point in a thickly wooded mountain ridge, which gives the hot, rainy island much of its picturesqueness. Of volcanic formation, Martinique is irregular in shape, with rugged, deeply indented coasts. Its area is 385 square miles. The French have a naval base at Fort-de-France, the capital.

Somewhat more than a third of the island is under cultivation. Sugar, rum, cocoa, coffee, tobacco, and cotton are among the leading products. The farms are served by well-built roads, and some of the sugar-cane plantations have little railroads of their own. The animal life consists largely of small reptiles and insects, but opossums and the Martinique blackbird are abundant. The deadly fer-de-lance serpent once was common, but the mongoose, imported from India, has all but exterminated it. (*See also* West Indies.)

Columbus is believed to have discovered Martinique, either in 1493 or in 1502. France seized and colonized it in 1635 and has held it since then, except for brief periods of British occupation—in 1762, from 1793 to 1801, and from 1809 to 1814. Negro slavery was introduced early but abolished in 1860.

Under the French constitution of 1946, the colony of Martinique became an overseas department. The department is under a prefect and sends representatives to the French Parliament. Population (1946 census), 261,595, chiefly Negro and mixed.

MARTYRS. "The blood of the martyrs," wrote one of the early Christian Fathers, "is the seed of the church." By the heroic courage with which they endured persecution and died for their faith, the early martyrs won thousands of converts and Christianity triumphed over Greek and Roman paganism.

The word *martyr* comes from the Greek and means a "witness." Stephen, who was stoned to death in the days of the Apostles (Acts vii) was the first of the Christian martyrs. Altogether about 14,000 martyrs are included in the records of the Roman Catholic church. Among the most famous are St. Lawrence who is said to have been roasted on a gridiron in the year 258, during the persecution of the Emperor Valerian; and St. Sebastian, a captain of the pretorian guard under Diocletian, who was condemned to be shot by a troop of archers for his faith. Sebastian's martyrdom has been a favorite subject with painters, who represent him as a handsome youth bound to a tree and pierced by arrows. In 1563 an English clergyman named John Foxe published a 'Book of Martyrs' commemorating those who had died for Protestant beliefs.

MARX, KARL (1818–1883). A brilliant youth, the son of a prosperous Jewish lawyer in Trèves, Karl Marx as a German university student was expected to win success in his father's profession. His mind, however, wandered away from his study of law to brood upon social and economic problems, and he became the founder of "Scientific Socialism" (Communism) and an influential revolutionary writer.

"Why are the laborers the poorest of all classes of people?" he asked himself. "Wealth is the product of their labor; yet of this wealth they receive scarcely a sufficient share to maintain life. The balance goes to those who command their labor, the capitalists. The capitalist class, then, is enriching itself by withholding from labor part of its rightful share." Reasoning in some such manner as this, Marx finally came to the conclusion that there was an inevitable conflict between labor and capital. All through history, as he saw it, this class struggle had been going on. It was slave against freeman in ancient times, serf against lord in the Middle Ages; and now between capitalist and laborer the struggle must continue until the workers should win from their oppressors the instruments of production and establish the socialist state.

These principles were first clearly formulated in the 'Communist Manifesto' drawn up by Marx and his friend Friedrich Engels as the program for the Communist League, which met in London in 1847. This famous document, with its rallying cry, "Workingmen of all countries unite!" marks the beginning of the modern international socialist movement. It is to modern Socialism what the Declaration of Independence is to America.

Before he became the founder and leader of Marxian Socialism, Karl Marx had passed through many hard experiences, and there were further trials in store for him. He had been editor of a paper in Germany which was suppressed because of its radical tendencies. He then went to Paris, but was expelled from France within two years and sought another home in Brussels. In the meantime he had married his childhood sweetheart, Jenny Von Westphalen, who though of gentler birth than himself and reared in luxury cheerfully shared the poverty which was often to bring them and their children to the verge of starvation. During the attempted Revolution of 1848 Marx returned to Germany, but was ordered to leave that land in 1849. He then settled in London, where he remained to the end of his life.

The "Bible of Socialism"

His death, hastened by overwork and by sorrow over the loss of his wife, came before he had finished his great work on political economy, entitled 'Capital'. This book, completed and edited by Engels, has been called the "Bible of Socialism." It is based on the so-called "materialistic" or "economic" view of history, which emphasizes the idea, as Engels puts it, "that first of all men must eat, drink, have shelter and clothing, and therefore must work, before they can struggle for supremacy and devote themselves to politics, religion, philosophy, etc."; and that therefore the social ideas and institutions of a time are determined mainly by economic conditions. Marx shows that the capitalistic era of production has played a necessary part in social development; but having reached its highest point, he claims, it must be followed by another order.

Marx emphasized the importance of "class struggles" and regarded as inevitable the revolution of the workers ("proletariat") against the capitalist class ("bourgeoisie"). He proposed methods for hastening this revolution. His teachings became the foundation of the Bolshevist program in Russia and of the present Soviet state. (*See also* Communism; Socialism.)

MARY, QUEENS OF ENGLAND. Only six English rulers have been women. Two bore the name Mary.

MARY I, or MARY TUDOR (born 1516, ruled 1553–1558), has come down in history with the unpleasant name of Bloody Mary because of the religious persecutions of her reign. She was the daughter of Henry VIII and Catherine of Aragon. None of Catherine's other children lived, and the king came to dislike his homely, sickly daughter, who was left as his sole heir. The princess' troubles increased after Henry VIII put aside her mother to marry Anne Boleyn. In order to annul the marriage, he cut England's ties with the pope. (*See* Henry VIII.) Mary clung stanchly to the Catholic faith in which she had been reared. Her situation improved after Henry VIII put Anne Boleyn, who hated Mary, to death. Henry later named Mary as second in succession after Edward, his son by his third wife, Jane Seymour.

Young Edward VI died after a short reign. A plot to put Lady Jane Grey, a Protestant, on the throne was defeated (*see* Grey), and the English people welcomed as their queen 37-year-old Mary, the legitimate heir. For a short time Mary was very popular. Soon, however, she alarmed the English people by marrying Philip of Hapsburg, heir to the Spanish throne. The English disliked this marriage because they feared England would become a province of Catholic Spain.

Mary held to the vain hope that she could win England back to the Catholic church. She had Parliament repeal the religious laws of her father's and brother's reigns and even succeeded in restoring the authority of the pope. Old laws for punishing heretics were revived and about 277 Protestants suffered death. During the reign of her father, Catholics had perished for their faith; but the public horror was much greater in Mary's reign because the heretics were burned at the stake. The most notable victim was Thomas Cranmer, archbishop of Canterbury, who had annulled Henry's marriage to Mary's mother. Other notable martyrs were Hugh Latimer, Nicholas Ridley, and Rowland Taylor.

Mary loved Philip, who was 11 years younger than she, but he neglected her. He left England in 1555, and became king of Spain in 1556 (*see* Philip II). The next year he returned to England for a few months to persuade Mary to help Spain in a war against France. In the struggle England lost Calais, which

had been its outpost on the continent since the days of Edward III. This was a great grief to Mary, who in her last illness declared that when she was dead Calais would be graven on her heart. She died of cancer and was succeeded by her half-sister Elizabeth I, daughter of Anne Boleyn.

MARY II (born 1662, ruled 1688–1694) was a Stuart, the elder daughter of James II. She became joint sovereign of Great Britain with her husband, William III, when the Revolution of 1688 drove her father from the throne (*see* William III). The administration was exclusively in the hands of William, but it was the queen who made the reign popular by her youth, good heart, and pleasing manners. She died of smallpox after only six years of reign, leaving no children. William III, as a foreigner and a person of cold reserved temperament, had a much more difficult task to face after her death.

The Tragic Story of MARY, QUEEN *of* SCOTS

MARY (QUEEN OF SCOTS), or **MARY STUART** (1542–1587). The life of Mary Stuart has been a favorite subject of dramatists and poets. Mary had beauty, charm, intelligence, and high courage; and she became the central figure in a complex political drama. She lived in the turbulent period of the Protestant Reformation, and she was a Catholic.

Mary Stuart was the daughter of James V, king of Scotland, and the French princess Mary of Lorraine. A few days after her birth her father died. The infant queen was pledged to marry Prince Edward of England (later Edward VI), but the Scots rightly feared that Edward's father, King Henry VIII, wanted to annex Scotland to England. They therefore preferred a French alliance; so Mary was betrothed instead to the Dauphin, Francis, heir to the French throne.

The child queen was sent to France. For ten years she lived with her mother's powerful relatives, the Guises, and acquired all the graces of the French court. "This small Queen of Scots," wrote her mother-in-law, Catherine de' Medici, "has only to smile in order to turn all French heads." At 15 she was married to the Dauphin.

In the same year Elizabeth I became queen of England. Catholic Europe regarded Mary Stuart as England's rightful queen, and Henry II of France ordered her and the Dauphin to assume the royal arms of England. Mary became queen of France as well as of Scotland when her husband became Francis II in 1559. The next year Francis died, leaving Mary a childless widow. She was then 18.

Reluctantly Mary sailed back to her Scottish homeland. The Scotland to which she returned was very different from the one she had left. Her mother, who acted as regent in her absence, had just died. French influence had waned as English power under Elizabeth I had grown. The Protestant Reformation, for which John Knox and others had long labored, was now established. From his pulpit Knox thundered denunciations of the Catholic queen (*see* Knox).

Both English and Scottish statesmen were concerned with finding a husband for Mary. As the granddaughter of Henry VIII's eldest sister, Mary was heiress to the crown of England if, as seemed likely, Queen Elizabeth should die unmarried and childless. To strengthen her claim, Mary married in 1565 handsome Henry Stuart, Lord Darnley, who also had a claim to the English crown. The marriage was a failure. Darnley was vain, weak, and eager for power.

Darnley's insolence and Mary's Catholicism produced discord between the queen and her Protestant subjects. A group of her enemies at the court pointed out to Darnley the rapid advancement with which the queen favored her Italian secretary, David Rizzio. Darnley became party to their plot; and Rizzio was dragged from the queen's presence at Holyrood Palace and murdered.

Mary pretended to pardon Rizzio's murderers. After the birth of her son, James, in 1566, she even agreed to a formal reconciliation with Darnley; but this did not last. The next year she persuaded her husband, who was ill, to move from Glasgow to a lonely house called Kirk-o'-Field just outside Edinburgh. One night the house was shattered by the explosion of barrels of gunpowder. The next morning Darnley's strangled body was found in the garden.

The queen was suspected of having had a part in her husband's murder. Knox intensified his campaign against her. The Scottish lords rose in revolt when three months after Darnley's death, Mary was married to the Earl of Bothwell, who had been exposed as the leader of Darnley's assassins. Mary's forces were defeated at Carberry Hill, near Edinburgh. The queen yielded herself a prisoner and was forced to abdicate in favor of her infant son, James VI. Bothwell fled to Denmark.

A Queen without a Country

For 11 months Mary was imprisoned in the island castle of Loch Leven. On May 2, 1568, she escaped by boat to the mainland, where her friends awaited her. An army rallied round her, only to be completely defeated at the village of Langside, south of Glasgow, by the regent Murray's forces. Mary fled; and according to her own account, she had to sleep on the ground, hungry and cold, for three nights. Then she crossed the border into England and cast herself upon the mercy of Queen Elizabeth. Elizabeth promptly had her taken into custody while a commission examined her guilt in regard to Darnley's murder.

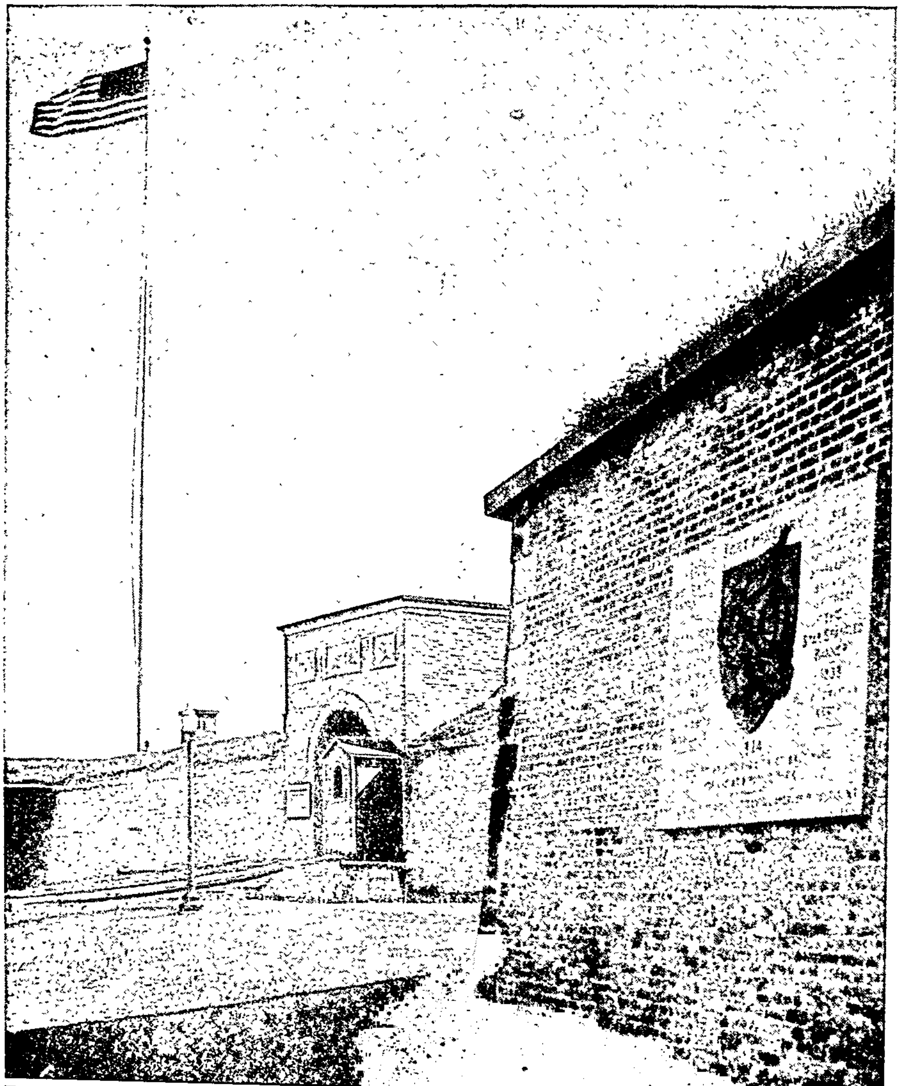
Letters found in a mysterious silver casket, supposedly written by Mary to Bothwell after his flight, were used against her to prove that she was aware of the plot to murder Darnley. The original letters, written in French, disappeared during Mary's lifetime, and there has been much controversy over the English translation, which was made from copies. The authenticity of the so-called Casket Letters has never been either established or disproved.

MARY, QUEEN OF SCOTS, BIDS FAREWELL TO FRANCE

It was with tears and heartbroken cries of farewell that Mary Stuart set sail from France for Scotland in 1561. A widow of 19, she was leaving the French court where she had been brought up and where for a short time she shared the throne with her husband, Francis II For Scotland, her homeland, she had not a single affectionate thought.

For 18 years Mary Stuart was Elizabeth's prisoner. English Catholics formed plot after plot to liberate her and place her on the throne of England. The Babington conspiracy of 1585—named after the ringleader, Anthony Babington—was the last and fatal link in a series which at length induced Elizabeth to bring Mary to trial (1586). Mary conducted her own defense with courage and eloquence, but was found guilty of complicity in a plot to assassinate Elizabeth. Elizabeth's councilors persuaded her to sign Mary Stuart's death warrant. On Feb. 8, 1587, Mary, dressed in black velvet and bearing herself like a queen, was beheaded in Fotheringay Castle, Northamptonshire. When Elizabeth died, 16 years later, Mary Stuart's son, James VI of Scotland, became James I of England, first of England's Stuart line.

GLORIES OLD *and* NEW *of "Maryland, My Maryland"*



From this flagpole on Fort McHenry in Baltimore harbor flew the flag that inspired Francis Scott Key to write 'The Star Spangled Banner', the national anthem.

MARYLAND. To anyone going south through the Atlantic coastal states, a difference becomes apparent upon entering Maryland. Here he makes his first contact with the Old South and its heritage of living built around splendid plantations.

Here, as in Virginia, is a tidewater region fringing the majestic sweep of Chesapeake Bay. In colonial times, many of the plantations could ship hogsheads of tobacco from their frontage on the bay or one of its many inlets and receive payment in manufactured goods and luxuries from England. The plantations farther inland could send tobacco to a landing in hogsheads, each pierced with an iron axle and dragged by a mule. Even today most of the tidewater farms and plantations turn their backs to the roads and face the water. The bay still is a much-used waterway for local traffic in small boats. Ocean vessels also use it to reach Baltimore, the sixth largest city and a major port in the United States.

Regions of Maryland

Maryland rises from sea level in the east to over 3,000 feet in the west. It is divided into three regions—the flat Atlantic coastal plain, or tidewater, the rolling Piedmont Plateau, and the mountainous Appalachian area.

The tidewater country comprises about half the state and ends at the *fall line*. This line is so-called for its waterfalls and extends from where the Susquehanna meets Chesapeake Bay southwest through Baltimore and Washington, D.C.

The bay divides the tidewater area. The Maryland part of the Delmarva Peninsula on the east bank of Chesapeake Bay is known as the Eastern Shore. Here are many poultry, truck, and fruit farms. Tomato growing and canning are especially important. The bay supports a thriving fish industry, particularly off the Eastern Shore. Oysters are the chief take. Blue and soft crabs, clams, and fin fish such as alewives, shad, and striped bass are also caught. Another delicacy, the diamondback terrapin is raised. Crisfield is a leading packer of seafood of the state. Marshes along the shore swarm with wild waterfowl, among them the canvasback duck. Here hunters trap muskrats. Many resorts are found along the bay and the Atlantic, including Ocean City, Maryland's largest resort. The Chesapeake Bay Bridge connects the Eastern Shore with the rest of the state. (*See* Chesapeake Bay.)

Upper Chesapeake Bay is industrial and includes Baltimore, the state's largest city (*see* Baltimore). About half the population of Maryland live here.

Farther south between Chesapeake Bay and the Potomac River lies the part called Southern Maryland. The state had its beginning here and so there are many historic places. Annapolis, the state capital, is the section's principal city (*see* Annapolis). Early Marylanders grew tobacco in this agricultural land and it is still important, but truck gardening, fruit growing, and dairying are increasing.

The hill or piedmont region of middle Maryland is a belt of about 40 miles across the inland neck of the state, with its western border at the foot of the Blue Ridge Mountains. It is a substantial farming country, raising fine wheat and grass, particularly where the limestone foundation crops up near the surface of the clayey soil. It also produces fine apples, peaches, and small fruits, corn and livestock. It is well wooded and threaded with many little cascading streams, known locally as "runs," which furnish considerable water power. It is truly "the garden of the Lord," as Whittier called it in 'Barbara Frietchie'. Many of Maryland's mineral products, such as building stone, come from the piedmont belt.

The little ragged strip of mountainous Maryland, running westward from the Blue Ridge to the Allegheny Mountains, contains superb scenery. The eastern part of this section is the fertile Hagerstown or Cumberland Valley, part of the Great Appalachian Valley. Farther west, where the topography becomes more rugged, most of the croplands are in the river valleys, and subsistence farming prevails. Lumbering and coal mining are important industries in the area.

THE PEACEFUL BEGINNING OF MARYLAND

This mural painting by Charles Yardley Turner in the Baltimore courthouse shows Leonard Calvert, Maryland's first governor, buying from the Indians the land for the first settlement. The fair and tolerant attitude of the new colony accounted for *the peace that prevailed there during its early years.*

Maryland is one of the smallest states of the Union, ranking 41st in size. But it ranks 24th in population and is one of the most densely populated states. A large majority of its people live in urban centers. Metropolitan and commercial greatness seem to have been forced upon a reluctant people. In colonial times, towns were started by royal decree, but few of them survived. So little did early Marylanders care for wealth from trade or industry, that the first proposals to build the city of Baltimore were firmly rejected by the owner of the land.

Challenges from the Sea and the West

The influence, however, of Chesapeake Bay and the sea could not be ignored. By 1800 maritime trade had helped make Baltimore the third ranking commercial city in the United States. After the War of 1812 "Baltimore clippers" became world-famous ships; and Baltimore was the nation's first maritime city.

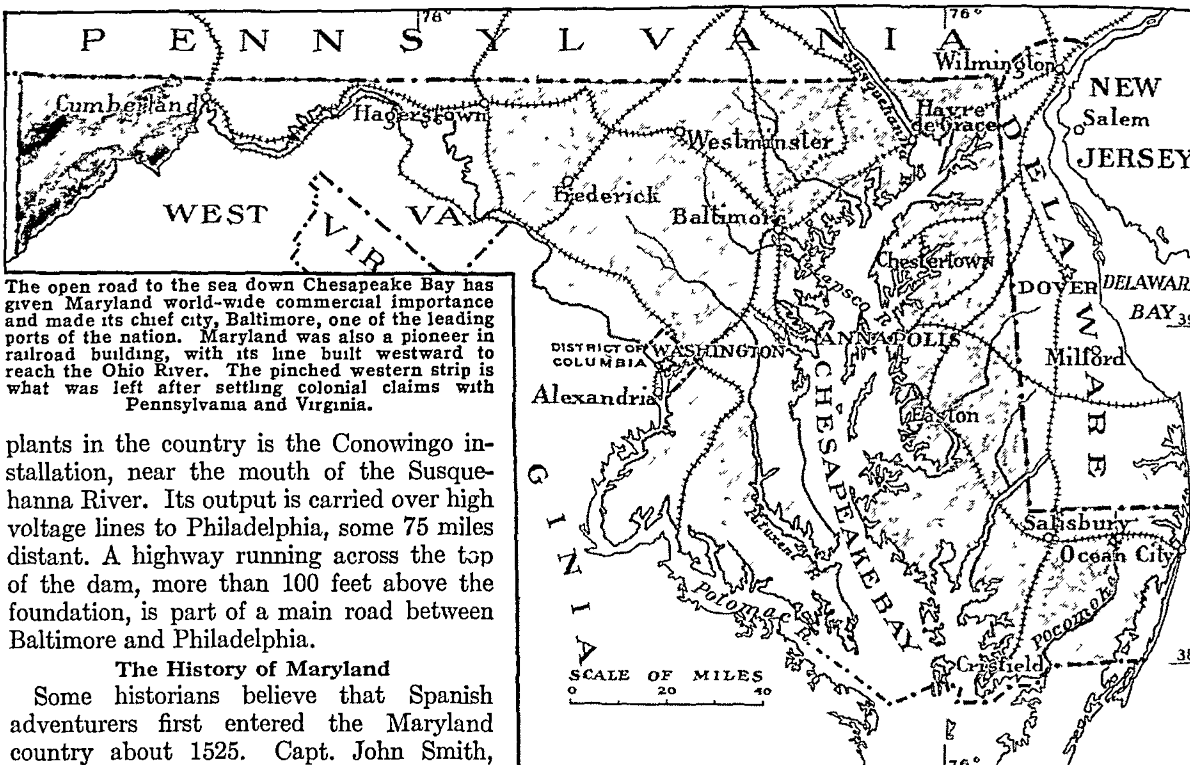
Then other cities, with harbors not so far from the open Atlantic, swung into the lead. The foresight of Maryland citizens, however, retrieved on land much of the advantage lost on sea. The city's answer was construction of the Baltimore and Ohio Railroad. Ground was broken in 1828, three years after the opening of the Stockton and Darlington Railroad in England. It was opened in 1830 with 14 miles of rails joining Baltimore and Ellicott's Mills—the first railway built in America to carry both passengers and freight. In 1853 the Baltimore and Ohio ran a train to Wheeling, W. Va., on the Ohio River. By 1874 the line had reached Baltimore Junction, on the outskirts of Chicago. Another factor in developing the state was the Chesapeake and Ohio Canal, built between 1828 and 1850. It stretched for 185 miles between Cumberland, Md., and the Potomac River at Washington, D. C. In 1952 the Chesapeake Bay Bridge between Kent Island and Sandy Point near Annapolis was completed. It is four miles long shore to shore and almost eight miles with its approaches.

The Industries of Maryland

Maryland's largest industry is the manufacture of food and kindred products. The most valuable products of this industry are distilled and malt liquors, canned fruits and vegetables, and bakery goods. The next largest industry is the production of primary metals. One of the world's largest steel works is at Sparrow's Point, near Baltimore. Another important industry is the building of aircraft, automobiles, and ships. Baltimore is the chief commercial and industrial city of Maryland.

The most important minerals mined are sand and gravel, cement, coal, and stone. Coal mining is a major industry in the westernmost counties of Allegany and Garrett. Other important minerals are clays and lime. Better iron and copper ores in other parts of the country have made the operation of the Maryland mines unprofitable. One of the greatest hydroelectric

A STATE OF RARE COMMERCIAL ADVANTAGES



The open road to the sea down Chesapeake Bay has given Maryland world-wide commercial importance and made its chief city, Baltimore, one of the leading ports of the nation. Maryland was also a pioneer in railroad building, with its line built westward to reach the Ohio River. The pinched western strip is what was left after settling colonial claims with Pennsylvania and Virginia.

plants in the country is the Conowingo installation, near the mouth of the Susquehanna River. Its output is carried over high voltage lines to Philadelphia, some 75 miles distant. A highway running across the top of the dam, more than 100 feet above the foundation, is part of a main road between Baltimore and Philadelphia.

The History of Maryland

Some historians believe that Spanish adventurers first entered the Maryland country about 1525. Capt. John Smith, leader of the Jamestown settlement of the Virginia Colony, charted the Chesapeake Bay region in 1608 and journeyed up the Potomac River to Georgetown (*see* Smith).

In 1631, William Claiborne and other Protestants from Virginia established the first settlement within the limits of Maryland. It was a trading post on Kent Island off the eastern shore of Chesapeake Bay, south of the inlet formed by the Chester River They, with others, protested the granting of a charter by Charles I to George Calvert, the first Lord Baltimore, who wished to found a colony in America for his fellow Roman Catholics in England. The charter was granted but Lord Baltimore died before the patent was actually issued, and it was given to his son Cecil, the second Lord Baltimore, in 1632. Nearly two years passed before Cecil Calvert sent out the first group of colonists, led by his brother Leonard Calvert.

The grant of lands embraced the present state of Maryland and parts of Pennsylvania and Delaware. It was named "Maryland" in honor of King Charles' wife, Henrietta Maria. The colonists settled about 10 miles up the river they named St. Marys, near the southern tip of the western shore. Here they bought fertile, cultivated fields from the Indians, paying in axes, hoes, and cloth.

Governor Calvert welcomed not only Catholics but non-Catholic Christians. In 1649 Maryland passed an Act of Toleration, according liberty of worship to all Trinitarian Christians—the first religious toleration act passed on American soil.

In 1649, Puritans from Virginia Colony made a settlement at Providence (now Annapolis), and with the help of Claiborne succeeded in getting the English Commonwealth to depose the Lord Proprietor from 1654 to 1658. In 1688, they again gained supremacy, and in 1692 Maryland became a Royal Colony. From 1692 until the time of the Revolution, the Church of England was the established church and everyone was taxed for its support. In 1715, the fifth Lord Baltimore, a Protestant, was made proprietor. A long dispute with Pennsylvania over the boundary line between the two colonies was settled in 1763–67 by the survey of Mason and Dixon's line (*see* Mason and Dixon's Line; Baltimore, Lords).

On Oct. 19, 1774, as a protest against the British tax on tea, the *Peggy Stewart* with its cargo of tea was burned in the Annapolis harbor. Marylanders still celebrate "Peggy Stewart Day." John Eager Howard was the hero of the Revolutionary battle of Cowpens. He became a governor of the state and a United States senator. In 1776, the Continental Congress fled to Baltimore from Philadelphia. Washington resigned his commission as commander-in-chief of the Continental army in the old senate chamber of the State House at Annapolis on Dec. 23, 1783.

Maryland delayed signing the Articles of Confederation until 1781, because it wanted the western lands to be ceded to the Union (*see* Northwest Territory). It ratified the Constitution in 1788 and gave 60 square miles of its territory, which later became a part of the District of Columbia, for the federal capital. During the War of 1812 Maryland was exposed to attack by the British fleet and army, and the bombardment of Fort McHenry in 1814 was the occasion

Continued on page 121

MARYLAND (Md.): Named from Terra Mariae, Land of Mary, for Queen Henrietta Maria, wife of Charles I. He granted patent for the province to George Calvert, Lord Baltimore.

Nickname: "Old Line State" for its troops during the Revolution; "Free State" for its tradition of freedom.

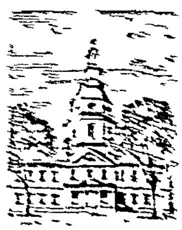
Seal: One side shows Lord Baltimore as armored knight mounted on charger; other side shows shield bearing arms of Calvert and Crossland families. Crossland, family name of first Lord Baltimore's mother.

Motto: Fatti Maschii Parole Femine (Manly Deeds, Womanly Words).

Flag: For description and illustration, see Flags.

Flower: Black-eyed Susan. **Bird:** Baltimore oriole. **Tree:** White oak. **Song:** "Maryland, My Maryland"—words, James Ryder Randall; set to tune of "O Tannenbaum."

THE GOVERNMENT



Capital: Annapolis (since 1694 in colonial days).

Representation in Congress: Senate, 2; House of Representatives, 7. Electoral votes, 9.

General Assembly: Senators, 29; term, 4 years. Delegates, 123; term, 4 years. Convenes first Wednesday in January in odd years for 90 days; budget session, first Wednesday in Feb. in even years for 30 days.

Constitution: Adopted 1867. Proposed amendment must be (a) passed by a three-fifths majority of elected members in each house of the legislature and (b) ratified by a majority voting on amendment at a popular election.

Governor: Term, 4 years. May succeed himself once.

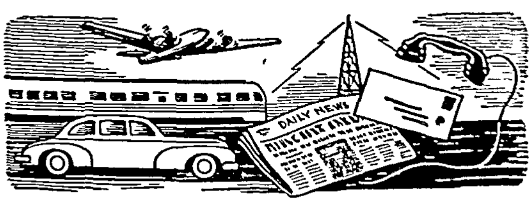
Other Executive Officers: Secy. of state, appointed by governor (with Senate approval); term, at governor's pleasure. Atty. gen., comptroller, both elected; treasr., appointed by assembly; terms for these, 4 years.

Judiciary: Court of Appeals—5 judges elected by districts; term, 15 years. Circuit courts—23 courts (8 circuits); judges elected; term, 15 years.

County: 23 counties, each governed by a board of 3 or 5 commissioners (one county has 8); boards and officers elected; terms, 4 years.

Municipal: Mayor-council most common; some towns have commission or manager form.

Voting Qualifications: Age, 21, residence in state, 1 year; in county and district, 6 months.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 1,300 miles. First railroad, Baltimore and Ohio (Baltimore to Ellicott's Mills), 1830. Rural roads, 16,500 miles. Airports, 49.

Communication: Periodicals, 102. Newspapers, 95. First newspaper, *Maryland Gazette*, Annapolis, 1727. Radio stations (AM and FM), 36; first station, WKC, Baltimore, licensed March 23, 1922. Television stations, 3; first station, WMAR-TV, Baltimore, began operation Oct. 27, 1947. Telephones, 819,500. Post offices, 542.

THE PEOPLE AND THEIR LAND

Population: 1950 census: 2,343,001; rank among 48 states—23rd; urban, 69.3%; rural, 30.7%. 237.1 persons per square mile; rank, 6th among states.

Extent: Area, 10,577 square miles, including 686 square miles of water surface; 42nd in size.

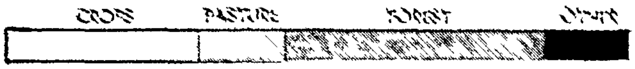
Elevation: Highest, Backbone Mountain in Garrett Co., 3,360 ft., 14 miles south of Oakland; lowest, sea level.

Temperature (°F.): Average—annual, 54°; winter, 34°; spring, 53°; summer, 73°; fall, 56°. Lowest recorded, −40° (Oakland, Jan. 13, 1912); highest recorded, 109° (Cumberland and Frederick, July 10, 1936, and at other locations and earlier dates).

Precipitation: Average (inches)—annual, 43; winter, 10; spring, 11; summer, 13; fall, 9. Varies from about 46 in. in south along Chesapeake Bay and in west, near north boundary, to about 41 in. in far west.

Natural Features: Chesapeake Bay divides east from west tidewater regions: Eastern Shore (peninsula to Delaware line) and Western Shore (peninsula to Potomac). Across inland neck of state is Piedmont Plateau, a gently rolling upland. In extreme west is Appalachian Region, which includes Blue Ridge and Allegheny mountains. Chief rivers: Chester, Choptank, Nanticoke, Patapsco, Patuxent, Potomac, Susquehanna.

Land Use: Cropland, 35%; nonforested pasture, 13%; forest, 37%; other (roads, parks, game refuges, wasteland, cities, etc.), 15%.



Natural Resources: *Agricultural*—variety of soils favors diversified farming, especially of food crops and tobacco. *Industrial*—coal, cement, sand and gravel, stone; fish; forests; hydroelectric power. *Commercial*—water frontage; near large markets, navigable waterways.

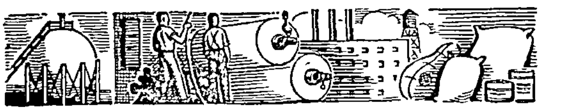
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Manufacturing.	223,201	25.0
Wholesale and retail trade	108,008	18.0
Transportation, communication, and other public utilities	82,331	9.9
Professional services (medical, legal, educational, etc.)	78,503	8.8
Government.	70,383	8.0
Construction . .	69,270	7.8
Personal services (hotel, domestic, laundering, etc.)	61,501	6.9
Agriculture, forestry, and fishery	50,288	6.0
Finance, insurance, and real estate	32,174	3.6
Business and repair services	20,307	2.3
Amusement, recreation, and related services . .	8,470	0.9
Mining . .	2,783	0.3
Workers not accounted for.	12,701	1.4
Total employed.	891,775	100.0

Maryland Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—15th)
Value added by manufacture* (1952), $1,706,104,000

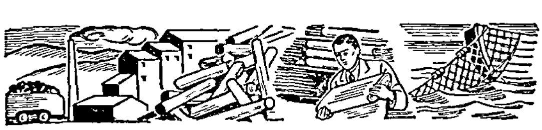
Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
FOOD AND KINDRED PRODUCTS... Distilled liquors; canned fruits, vegetables, soups; bakery goods	$189,486,000	16
PRIMARY METAL INDUSTRIES.... Blast furnace, steel mill and iron and steel foundry products	158,832,000	11
TRANSPORTATION EQUIPMENT.... Aircraft and parts, shipbuilding; motor vehicles and parts	150,823,000	11
CHEMICALS AND ALLIED PRODUCTS. Drugs and medicines; fertilizers; paints; soap and glycerin	142,559,000	14
APPAREL AND RELATED PRODUCTS. Men's and boys' suits and coats; men's dress shirts and nightwear	93,695,000	9

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—36th)
Total cash income (1952), $262,708,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Milk...........	493,000,000 qts.	1	30
Chickens.......	129,936,000 lbs.	2	10
Corn...........	16,674,000 bu.	3	27
Truck crops.....	456,000 tons	4	8
Tobacco........	32,966,000 lbs.	5	9
Eggs...........	38,000,000 doz.	6	32
Hay...........	594,000 tons	7	38

*Rank in dollar value †Rank in units produced



C. Fish (Rank among states—11th)
(Marine waters and coastal rivers, 1950), catch, 67,092,000 lbs.; value, $8,888,000

D. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $26,027,000
Rank among states—38th

Minerals (1951)	Amount Produced	Value
Sand and gravel........	7,054,000 tons	$8,171,000
Stone................	3,181,000 tons	5,983,000
Cement*.............	....	....
Coal.................	589,000 tons	2,781,000

*Cement ranks 3d in value; exact figures not available.

E. Trade

Trade (1948)	Sales	Rank among States
Wholesale...........	$2,083,715,000	22
Retail..............	1,914,689,000	22
Service.............	184,231,000	18

EDUCATION

Public Schools: Elementary, 793; secondary, 209. Compulsory school age, 7 through 15. State Board of Education, 7 members appointed by gov., 7-yr. terms. State supt. of schools appointed by state board, 4-yr. term. County boards of education, 3 to 7 members appointed by gov. in 22 counties (6-yr. terms in 20 counties, 5-yr. terms in 2), elected in 1 county (4-yr. terms). County supts. appointed by county boards of education, 4-yr. terms. County boards control all city schools. Baltimore board, commissioners appointed by mayor, 6-yr. terms.

Private and Parochial Schools: 338.

Colleges and Universities (accredited): Colleges—white, 18; Negro, 4. Junior colleges—white, 10; Negro, 2. State-supported institutions include the University of Maryland, College Park, with its Baltimore campus; 5 state teachers colleges—Towson, Frostburg, and Salisbury (for white students); Bowie, and Coppin at Baltimore (for Negro students); 2 Negro colleges—Morgan State, Baltimore; and Princess Anne.

Special State Schools: School for the Deaf, Frederick; Rosewood State Training School for Feeble-minded, Owings Mills. Maryland School for the Blind, Overlea, a private institution, receives state aid.

Libraries: City and town public libraries, 15; independent county library systems, 14; Division of Library Extension, State Department of Education, responsible for aid in developing school and public library service. Noted special libraries: Peabody Institute, Maryland Historical Society, Protestant Episcopal Church in Maryland Diocesan Library, all in Baltimore; Maryland State Library (notably its Law Library), Annapolis.

Outstanding Museums: Walters Art Gallery, Baltimore Mus. of Art, Md. Academy of Sciences, Md. Hist. Soc., Municipal (Peale) Mus., all in Baltimore; U. S. Naval Academy Mus., Annapolis.

CORRECTIONAL AND PENAL INSTITUTIONS

Md. Training School (for boys), Loch Raven; Boys Village (Negro), Cheltenham; Montrose School for Girls, Reisterstown; Barrett School for Girls (Negro), Glen Burnie; State Reformatory for Males, Breathedsville; State Reformatory for Women, House of Correction, and Patuxent Inst., all at Jessups (near Savage); Md. Penitentiary, Baltimore.

STATE PARKS*

Dans Mountain—hiking, picnicking; under development; near Lonaconing; east of symbol (4).

Elk Neck—near Elkneck; forest on peninsula between Chesapeake Bay and Elk River; picnicking (17).

Fort Frederick—near Clear Spring; restored fort built 1756 during French and Indian Wars; museum (8).

Fort Tonoloway—undeveloped; near Hancock; w. of (8).

Gambrill—near Frederick; views from High Knob on Catoctin Mountain (1,600 feet); picnicking (12).

Gathland—near Burkittsville; on Appalachian Trail, Maine-Georgia footpath; Civil War Correspondents Monument; under development (11).

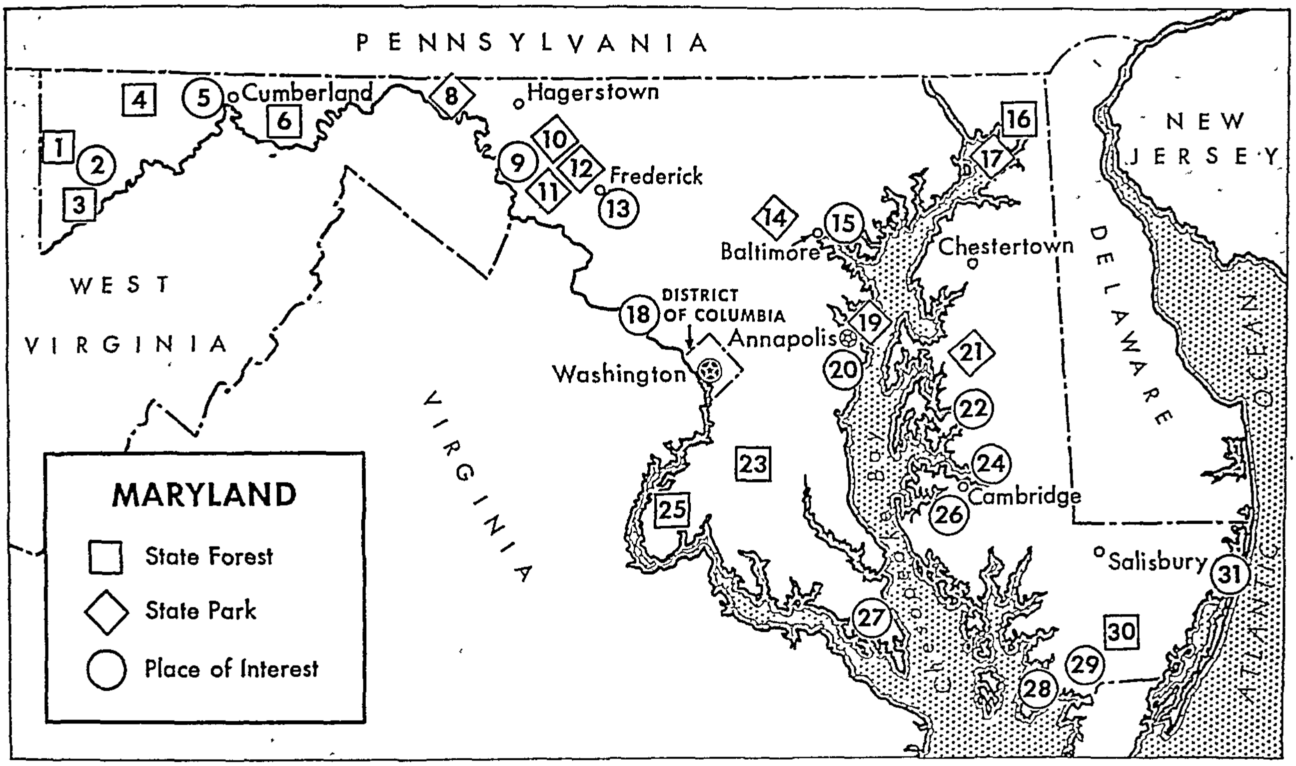
Patapsco—near Baltimore; wooded hills along Patapsco River; cascades and waterfalls; picnicking (14).

Rocks—geologic formations; King and Queen seat of ancient Indian lore; picnicking; under development; near Bel Air; west of symbol (17).

Sandy Point—on Chesapeake Bay; beaches (19).

*Numbers in parentheses are keyed to map.

Maryland Fact Summary



Seneca Creek—picnicking, fishing; under development; near Gaithersburg; northeast of symbol (18).

Washington Monument—on South Mountain near Boonsboro; 34-foot George Washington monument (10).

Wye Oak—near Wye Mills; contains 400-year-old white oak tree, 95 feet high, 165-foot spread (21).

STATE FORESTS*

Cedarville (Charles, Prince Georges Cos.)—3,510 a. (23).
Doncaster (Charles Co.)—1,464 a. (25).
Elk Neck (Cecil Co.)—2,939 a. (16).
Green Ridge (Allegany Co.)—25,631 a. (6).
Pocomoke (Worcester Co.)—12,377 a. (30).
Potomac (Garrett Co.)—12,057 a. (3).
Savage River (Garrett Co.)—52,672 a. (4).
Swallow Falls (Garrett Co.)—7,457 a. (1).

PLACES OF INTEREST*

Annapolis—U.S. Naval Academy; State House (1772); Old Treasury (1695); St. John's College (1696); Hammond-Harwood House (1774) (*see* Annapolis) (20).

Antietam National Battlefield Site—commemorates battle of Antietam, 1862; National Cemetery (9).

Baltimore—many historic places; Flag House; Fort McHenry Natl. Mon. and Historic Site; 200-ft. Washington Monument; Johns Hopkins Univ.; Baltimore and Ohio Transportation Museum (*see* Baltimore) (15).

Cambridge—port city; graves of Revolutionary War heroes, Christ Church (1695); 18th-century homes (24).

Catoctin Recreational Demonstration Area—camping; in National Capital Parks; north of Frederick and (13).

Chesapeake and Ohio Canal—restored section (Georgetown, D. C., to Seneca) with locks and towpath; part of National Capital Parks (18).

Chesapeake Bay Bridge—great bridge to Eastern Shore, Sandy Point-Kent Island; at symbol (19).

Church Creek—quiet town built about 1700; many original buildings and Old Trinity Church remain (26).

Crisfield—crab and oyster catches landed at this fishing village; diamondback terrapin "farms" (28).

Crystal Grottoes of Maryland—near Boonsboro; jewel-like limestone formations beneath surface (9).

Cumberland—original settlement was Fort Mt. Pleasant, established by Washington, 1754; nearby is Cumberland Narrows, mountain gorge with 1,000-ft. cliff (5).

Deep Creek Lake—scenic, mountainous resort area (2).

Frederick—replica of Barbara Frietchie's House; Roger Brooke Taney Home exhibits relics used by Chief Justice Taney and Francis Scott Key (13).

Hampton National Historic Site—outstanding Georgian mansion built about 1783; n. e. of Baltimore (15).

Monocacy Battlefield—site of Union defeat (1864) when Confederate army threatened Washington, D. C. (13).

Ocean City—resort on Barrier Reef; marlin fishing (31).

Rehoboth Presbyterian (Makemie's) Church—built 1705-6; used continuously by Presbyterians (29).

St. Marys—early settlement in state (1634); reproduction of State House (1676); Trinity Church (1829) (27).

Third Haven Meeting House—Easton; built 1684; believed to be oldest frame house of worship in U. S. (22).

LARGEST CITIES (1950 census)

Baltimore (949,708): Atlantic port on Chesapeake Bay; historic and industrial city; steel mills, shipbuilding and repairs; makes aircraft, radios, clothing.

Cumberland (37,679): industrial city on Potomac River; large railroad shops; makes rayon, tires.

Hagerstown (36,260): industrial city in Cumberland Valley; aircraft, textiles, machinery, shoes, pipe organs.

Frederick (18,142): historic city, rich farm area; clothing.

Salisbury (15,141): port; shirts, food processing.

Takoma Park (13,341): Seventh-day Adventist hdqrs.

Hyattsville (12,308): suburb of Washington, D. C.

College Park (11,170): suburb; Univ. of Md.; radios.

Mount Rainier (10,989): suburb of Washington, D. C.

Cambridge (10,351): port; vegetable and fish processing.

Annapolis (10,047): state capital; U. S. Naval Academy.

*Numbers in parentheses are keyed to map.

Maryland Fact Summary

THE PEOPLE BUILD THEIR STATE

1608—Capt. John Smith, leader of Jamestown Colony, charts the Chesapeake Bay region.

1631—William Claiborne establishes trading post on Kent Island as an outpost of Virginia.

1632—Charles I of England grants to George Calvert, Lord Baltimore, land between "south bank" of Potomac River and 40th parallel; province named Maryland in honor of Queen Henrietta Maria. Upon death of Calvert, charter passes to his son, Cecilius (Cecil), second Lord Baltimore.

1634—First settlers, led by Leonard Calvert, arrive at St. Clement's (now Blakistone) Island in vessels *Ark* and *Dove*; buy Indian village of Yaocimico, where they found St. Marys, first provincial capital.

1635—St. Marys' settlers battle with Claiborne's colonists; peace secured in 1636 with Marylanders triumphant; first General Assembly meets at St. Marys; Lord Baltimore refuses to recognize it.

1638—General Assembly rejects laws sent out by Lord Baltimore; eventually he gives Assembly right to initiate legislation with assent of his governor. Board of Commissioners for Plantations in London declares Kent Island part of Maryland.

1645—Capt. Richard Ingle and parliamentarians (supporters of Cromwell in England) seize St. Marys; Claiborne seizes Kent Island; Calvert seeks aid from Virginia, defeats insurgents, 1646.

1649—Act Concerning Religion passed in Maryland; it is first act of religious toleration in American colonies. Puritans from Virginia found Providence (later called Anne Arundel Towne).

1652—Seven Susquehanna Indian tribes make peace treaty with Maryland settlers.

1654—English Commonwealth deposes Maryland proprietor; proprietor's government restored, 1658.

1660—Assembly meets again, beginning 30 peaceful years.

1692—Maryland becomes a royal colony; Church of England becomes established church.

1694—Seat of government moved from St. Marys to Anne Arundel Towne (now Annapolis).

1697—Most Piscataway Indians move westward.

1701—First "free school" in Maryland opens at Annapolis.

1742—Eastern Shore Indians begin to move westward.

1755—After General Braddock's defeat, French and Indians attack settlements in western Maryland; attacks end with peace in 1763. Monocacy Road, west from Wills Creek (Fort Cumberland) is first highway to cross Allegheny Mountains.

1763—Charles Mason and Jeremiah Dixon survey Pennsylvania-Maryland boundary line (later called Mason and Dixon's Line).

1769—Settlers' convention decides to boycott British goods in protest against Townshend Acts.

1774—Maryland patriots burn ship *Peggy Stewart* and its cargo of British tea in Annapolis harbor, October 19.

1776—Provincial Convention votes for independence, July 3; Continental Congress, fearing capture by British, flees to Baltimore. Maryland constitutional convention meets, August 14; state constitution adopted, November 8.

1777—Admiral Howe's fleet lands troops near Elk River; they defeat colonists at Brandywine Creek.

1778—Count Casimir Pulaski organizes the "Pulaski Legion" in Baltimore.

1784—Treaty of Paris ratified by Congress of the Federation at Annapolis. Methodist Episcopal church organized in Baltimore.

1786—Annapolis Convention held; representatives from colonies vote to send delegates to Constitutional Convention in Philadelphia, 1787.

1788—Maryland is 7th state to ratify U. S. Constitution, April 28; cedes land to form District of Columbia.

1790—John Carroll consecrated bishop of Baltimore, first Roman Catholic bishop in U. S. Bank of Maryland established; fails, 1834.

1801—State constitutional amendment gives vote to all free white males.

1804—Construction of Chesapeake and Delaware Canal begins; completed, 1829.

1807—College of Medicine of Maryland founded; granted charter as University of Maryland, 1812.

1814—British army in War of 1812, advancing on Washington from Patuxent River, defeats Americans in battle of Bladensburg; British fleet bombards Fort McHenry September 13–14; Francis Scott Key writes 'The Star Spangled Banner.'

1818—Cumberland Road (National Pike) to the Ohio River completed as far as present Wheeling, W. Va.

1826—Public school system established.

1827—Baltimore & Ohio Railroad chartered; locomotive "Tom Thumb" runs from Baltimore to Ellicott's Mills, 1830; line opens to Washington, 1833; St. Louis, 1857; Pittsburgh, 1871; Chicago, 1874.

1828—Construction of Chesapeake and Ohio Canal begins; completed to Cumberland, 1850.

1837—Constitutional amendment (state) provides for direct election of governor and senators.

1840—Baltimore College of Dental Surgery, first dental college in U. S., opens; becomes part of University of Maryland, 1923.

1844—First telegraph line in U. S. links Baltimore and Washington, D. C.

1845—U. S. Naval Academy opens at Annapolis.

1861—Baltimore crowd attacks Massachusetts troops marching through city; Maryland put under military supervision but remains loyal to Union.

1862—Confederates occupy Frederick; McClellan defeats Confederates at South Mountain, September 14; at Antietam (Sharpsburg), September 16–17.

1863—Confederates invade again in June; driven back after battle of Gettysburg, Pa.

1864—Confederates invade state a third time. State constitution abolishing slavery adopted.

1867—Present state constitution adopted.

1874—Virginia and Maryland agree on boundary; strip of Eastern Shore passes to Virginia.

1876—Johns Hopkins University opens in Baltimore.

1899—Henry L. Mencken begins his famous journalistic career in Baltimore.

1902—Maryland is first state to enact a Workmen's Compensation Law.

1912—Supreme Court decision awards area in western Maryland to West Virginia.

1922—State government is reorganized.

1949—"Ober law" requires loyalty oath of candidates for state and city offices; upheld by United States Supreme Court, 1951.

1951—Repeals 1904 law requiring segregation of races in intrastate trains and steamboats; U. of Maryland accepts Negro medical and graduate students.

1952—Chesapeake Bay Bridge completed between Kent Island and Sandy Point near Annapolis.

MARYLAND

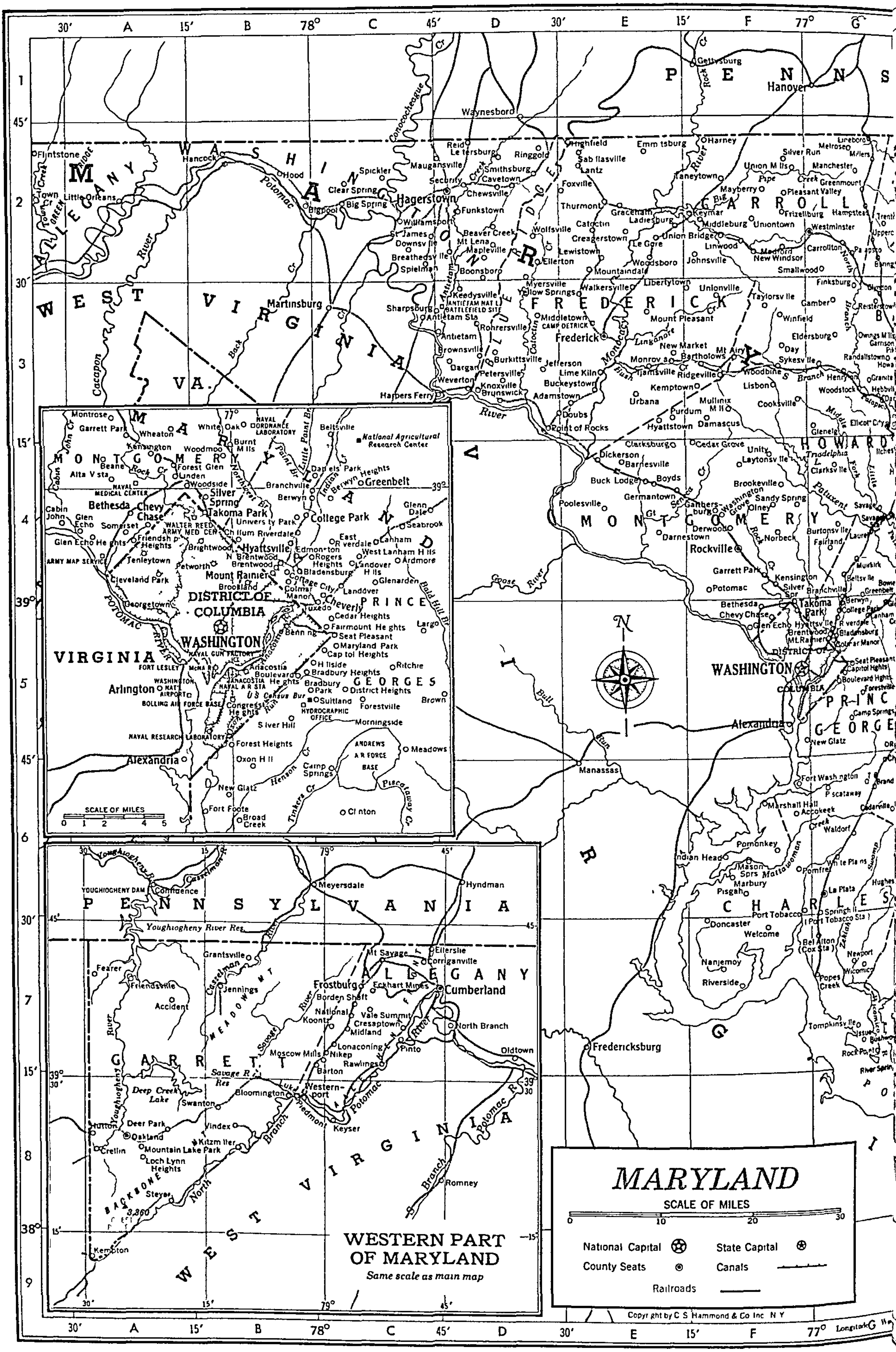
COUNTIES

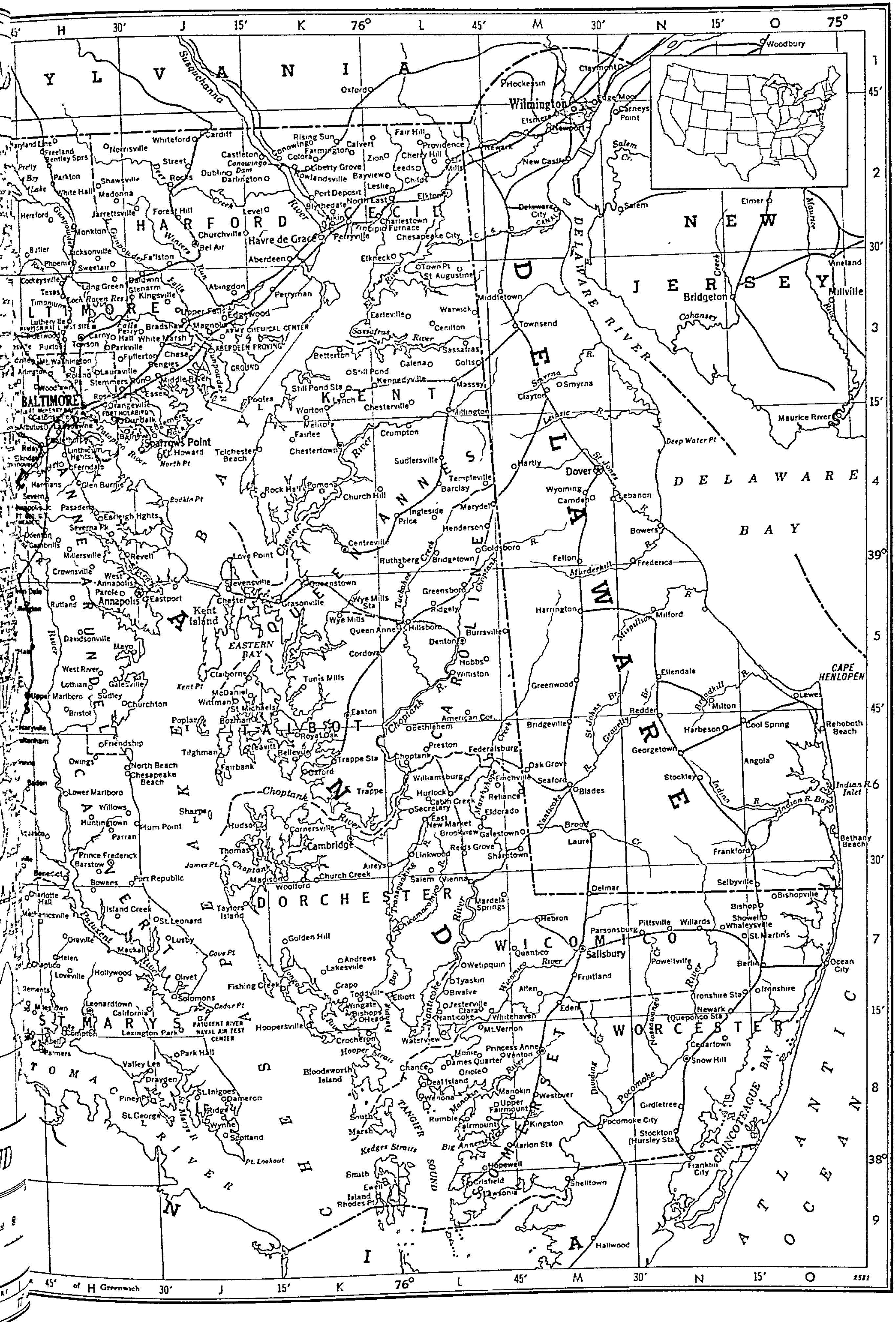
Allegany	89,556	A 2
Anne Arundel	117,392	H 4
Baltimore	270,273	H 3
Baltimore City	949,708	H 3
Calvert	12,100	H 6
Caroline	18,234	L 5
Carroll	44,907	F 2
Cecil	33,356	L 2
Charles	23,415	F 6
Dorchester	27,815	K 7
Frederick	62,287	E 3
Garrett	21,259	A 7
Harford	51,782	J 2
Howard	23,119	G 4
Kent	13,677	K 3
Montgomery	164,401	E 4
Prince Georges	194,182	G 5
Queen Annes	14,579	L 4
Saint Marys	29,111	H 7
Somerset	20,745	M 8
Talbot	19,428	K 5
Washington	78,886	C 2
Wicomico	39,641	M 7
Worcester	23,148	N 8

CITIES AND TOWNS

Abell	400	H 8
Aberdeen	2,944	K 2
Abingdon	650	J 3
Accident	242	A 7
Accokeek		G 6
Adamstown	265	D 3
Aikin		K 2
Aireys	110	K 6
Allen	350	M 7
Alta Vista	3,000	A 4
American Corner	15	L 5
Andrews		K 7
ANNAPOLIS	10,047	H 5
Annapolis Jct.	322	H 4
Antietam	250	D 3
Antietam Sta.	50	D 3
Aquasco		G 6
Arbutus	4,000	H 3
Ardmore	500	C 4
Arlington	71,750	H 3
Baden	150	H 6
Baldwin	350	J 3
Balnew	1,500	H 4
Baltimore	949,708	H 3
Barclay	108	L 4
Barnesville	130	E 4
Barstow	151	H 6
Bartholows	100	F 3
Barton	695	C 7
Bayview		L 2
Beane	50	A 4
Beaver Creek	50	D 2
Bel Air	2,578	J 2
Bel Alton	250	G 7
Bellevue	300	K 6
Beltsville	800	C 3
Benedict	250	H 6
Bengies	500	J 3
Bentley Sprs.	130	H 2
Berlin	2,001	O 7
Berwyn		B 4
Berwyn Hts.	674	C 4
Bethesda	36,000	A 4
Bethlehem		L 6
Betterton	314	K 3
Big Spring	125	C 2
Bigpool	175	C 2
Bishop	25	N 7
Bishops Head	300	K 7
Bishopville	375	O 7
Bivalve	270	L 7
Bladensburg	2,899	C 4
Bloomington	400	B 8
Blythedale	100	K 2
Boonsboro	1,071	D 2
Borden Shaft	419	C 7
Boring	130	G 2
Boulevard Hts.		B 5
Bowens	220	H 6
Bowie	860	G 4
Boyds	250	E 4
Bozman		J 5
Bradbury Hts.	1,800	C 5
Bradbury Park	500	C 5
Bradshaw	500	J 3
Branchville	500	B 4
Brandywine	1,000	G 6
Breathedsville	150	C 2
Brentwood	3,523	B 4
Bridgetown	16	L 4
Bristol	300	H 5
Broad Creek	50	B 6
Brookeville	117	F 4
Brookview	150	L 6
Brown	200	C 5
Brownsville	202	D 3
Brunswick	3,752	D 3
Buck Lodge	100	E 4
Buckeystown		E 3
Burkittsville	190	D 3
Burnt Mills	100	B 3
Burrsville	200	L 5
Burtonsville		G 4
Bushwood	300	G 7
Butler	57	H 2
Cabin Creek		L 6
Cabin John	2,000	A 4
California	250	H 7
Calvert	150	K 2
Cambridge	10,351	K 6
Camp Springs	315	C 6
Capitol Hts.	2,729	C 5
Cardiff	325	J 2
Carney	1,523	H 3
Carrollton	180	G 2
Castleton	343	J 2
Catoctin	300	E 2
Catonsville	29,638	H 3
Cavetown	300	D 2
Cecilton	510	L 3
Cedar Grove	200	F 4
Cedar Heights	788	C 5
Cedartown	50	N 8
Cedarville	200	G 6
Centreville	1,804	K 4
Chance	400	L 8
Chaptico	350	H 7
Charlestown	551	L 2
Charlotte Hall	150	H 7
Chase	900	J 3
Cheltenham	500	G 6
Cherry Hill	300	L 2
Chesapeake Beach	504	J 6
Chesapeake City	1,154	L 2
Chester	1,100	J 5
Chestertown	3,143	K 4
Chesterville	36	L 3
Cheverly	3,318	C 4
Chevy Chase	1,971	A 4
Chewsville	180	D 2
Childs	90	L 2
Chillum	15,000	B 4
Choptank		L 6
Church Creek	187	K 6
Church Hill	271	K 4
Churchton		J 5
Churchville		J 2
Claiborne	150	J 5
Clara	200	L 7
Clarksburg	367	E 4
Clarksville	200	G 4
Clear Spring	558	C 2
Clements	300	G 7
Clinton	500	C 6
Cockeysville	3,000	H 3
College Park	11,170	C 4
Collington		G 5
Colmar Manor	1,732	B 4
Colora	190	K 2
Compton	500	H 7
Conowingo	500	K 2
Cooksville	150	F 3
Cordova	500	K 5
Cornersville	100	K 6
Corriganville		D 7
Cottage City	1,249	B 4
Crapo		K 7
Creagerstown	325	E 2
Crellin	500	A 8
Cresaptown	2,000	C 7
Crisfield	3,688	L 9
Crocheron		K 8
Crownsville	350	H 4
Crumpton	240	L 4
Cumberland	37,679	D 7
Damascus	1,000	F 3
Dameron	250	J 8
Dames Quarter	450	L 8
Daniels	800	G 3
Daniels Park	750	C 4
Dargan	300	D 3
Darlington	500	J 2
Darnestown	200	E 4
Davidsonville	900	H 5
Day		F 3
Deal Island	1,200	L 8
Deer Park	320	A 8
Delmar	1,328	M 7
Denton	1,806	L 5
Derwood	300	F 4
Dickerson	300	E 4
District Hts.	1,735	C 5
Doncaster		F 7
Doubs	250	E 3
Downsville	210	C 2
Drayden	300	J 8
Dublin	250	J 2
Dundalk	40,182	J 3
Eagle Harbor	7	*F 6
Earleigh Hts.	400	H 4
Earleville	42	L 3
E. New Market	264	L 6
E. Riverdale	1,200	C 4
Easton	4,836	K 5
Eastport	4,594	J 5
Eckhart Mines	2,350	C 7
Eden	150	M 7
Edgemere	6,000	J 3
Edgewood		J 3
Edmonston	1,190	C 4
Eldersburg	300	G 3
Eldorado	79	L 6
Elk Mills	300	L 2
Elkneck		L 2
Elkridge	3,000	H 4
Elkton	5,245	L 2
Ellerslie	850	D 7
Ellerton	41	D 2
Ellicott City	1,500	G 3
Elliott	130	L 7
Emmitsburg	1,261	E 2
Essex	35,000	J 3
Ewell	400	K 9
Fair Hill	150	L 2
Fairbank	300	J 6
Fairland		G 4
Fairlee	240	K 4
Fairmount	600	L 8
Fairmount Heights	2,097	C 5
Fallston	300	J 2
Farmington	50	K 2
Fearer	50	A 7
Federalsburg	1,878	L 6
Ferndale	2,500	H 4
Finchville	3	M 6
Finksburg	500	G 3
Fishing Creek	700	J 7
Flintstone	170	A 2
Forest Glen	1,500	B 4
Forest Hts.	1,125	B 5
Forest Hill	300	J 2
Forestville	1,500	C 5
Fort Foote	75	B 6
Ft. Howard	1,000	J 4
Ft. Washington	210	G 6
Foxville	150	E 2
Frederick	18,142	E 3
Freeland	200	H 2
Friendship	300	H 6
Friendship Heights	315	A 4
Friendsville	607	A 7
Frizellburg	193	F 2
Frostburg	6,876	C 7
Fruitland	1,028	M 7
Fullerton	2,500	J 3
Funkstown	879	D 2
Gaithersburg	1,755	F 4
Galena	259	L 3
Galestown	100	L 6
Galesville	900	H 5
Gamber	600	G 3
Gambrills	500	H 4
Garrett Park	524	A 3
Garrison	1,000	G 3
Germantown	200	E 4
Girdletree	200	N 8
Glen Burnie	8,000	H 4
Glen Echo	356	A 4
Glen Echo Hts.	600	A 4
Glenarden	492	C 4
Glenarm	350	J 3
Glenelg	40	G 3
Glenn Dale	625	C 4
Glyndon	500	G 3
Golden Hill		K 7
Goldsboro	198	L 4
Golts	100	L 3
Graceham	225	E 2
Granite	600	G 3
Grantsville	461	B 7
Grasonville	1,200	K 5
Greenbelt	7,074	C 4
Greenmount	200	G 2
Greensboro	1,181	L 5
Hagerstown	36,260	C 2
Halethorpe	5,000	H 4
Hall	195	G 5
Hampstead	677	G 2
Hancock	963	B 2
Hanover	1,000	G 4
Harmans	200	H 4
Harney	142	F 2
Havre de Grace	7,809	K 2
Hebbville	150	G 3
Hebron	723	M 7
Helen	125	H 7
Henderson	106	L 4
Henryton	600	G 3
Hereford	310	H 2
Highfield	1,000	E 2
Highland Beach	5	*J 5
Hillsboro	179	L 5
Hillside	3,000	C 5
Hobbs	95	L 5
Hollywood	800	H 7
Hood	11	B 2
Hoopersville	300	K 7
Hopewell	200	L 8
Howardville		G 3
Hudson	200	J 6
Hughesville	550	G 6
Huntingtown	438	H 6
Hurlock	944	L 6
Hutton	350	A 8
Hyattstown	135	E 3
Hyattsville	12,308	B 4
Ijamsville		E 3
Ilchester	200	G 4
Indian Head	491	F 6
Ingleside	150	L 4
Ironshire	100	O 7
Ironshire Sta.	25	N 7
Island Creek	250	H 7
Issue	160	G 7
Jacksonville	75	H 2
Jarrettsville	250	H 2
Jefferson	275	E 3
Jennings	300	B 7
Jesterville	175	L 7
Johnsville	200	F 2
Keedysville	417	D 3
Kempton	260	A 9
Kemptown	200	E 3
Kennedyville	180	L 3
Kensington	1,611	A 4
Keymar	230	F 2
Kingston	50	M 8
Kingsville	200	J 3
Kitzmiller	652	B 8
Knoxville	750	D 3
Koontz		B 7
La Plata	780	G 6
Ladiesburg	126	E 2
Lakesville	37	K 7
Landover	1,175	C 4

*No room on map for name.


MARYLAND
SCALE OF MILES
0 10 20 30
National Capital
State Capital
County Seats
Canals
Railroads
Copyright by C S Hammond & Co Inc N Y
PENNS
WASHINGTON
ALLEGANY
FREDERICK
CARROLL
HOWARD
MONTGOMERY
PRINCE GEORGES
CHARLES
WEST VIRGINIA
VA.
VIRGINIA
Potomac River
Hagerstown
Frederick
Rockville
WASHINGTON
Alexandria
Manassas
Fredericksburg
Gettysburg
Hanover
Waynesboro
Hancock
Martinsburg
Harpers Ferry
Westminster
Cumberland
La Plata
DISTRICT OF COLUMBIA
Silver Spring
Takoma Park
Bethesda
Chevy Chase
Hyattsville
College Park
Greenbelt
Beltsville
Arlington
Mount Rainier
National Agricultural Research Center
ANDREWS A R FORCE BASE
SCALE OF MILES
0 1 2 3 4 5
WESTERN PART OF MARYLAND
Same scale as main map
PENNSYLVANIA
GARRETT
ALLEGANY
WEST VIRGINIA
Frostburg
Cumberland
Oakland
Westernport
Grantsville
Deep Creek Lake
Youghiogheny River Res.
Keyser
Romney
Meyersdale
Hyndman
BACKBONE MT 3,360



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D E L A W A R E
D E L A W A R E
B A Y
DELAWARE RIVER
HARFORD
CECIL
KENT
QUEEN ANNES
CAROLINE
TALBOT
DORCHESTER
WICOMICO
WORCESTER
SOMERSET
ST. MARYS
CALVERT
ANNE ARUNDEL
BALTIMORE
CHESAPEAKE BAY
ATLANTIC OCEAN
TANGIER SOUND
EASTERN BAY
CHINCOTEAGUE BAY
CAPE HENLOPEN
Wilmington
Baltimore
Annapolis
Dover
Salisbury
Cambridge
Easton
Elkton
Havre de Grace
Bel Air
Chestertown
Centreville
Denton
Georgetown
Snow Hill
Princess Anne
Crisfield
Ocean City
Lewes
Rehoboth Beach
Milford
Seaford
Laurel
Delmar
Pocomoke City
Bridgeton
Millville
Vineland
Salem
Newark
New Castle
Middletown
Smyrna
Harrington
Sparrows Point
Prince Frederick
Leonardtown
Solomons
Susquehanna
Woodbury
Claymont
Hockessin
Elsmere
Carneys Point
Delaware City
Chesapeake City
Rising Sun
Port Deposit
Aberdeen
Perryman
Towson
Glen Burnie
Kent Island
Tilghman
Oxford
St. Michaels
Hurlock
Vienna
Berlin
Frankford
Selbyville
Bethany Beach
Millsboro
Franklin City
Smith Island
Bloodsworth Island
Hooper Strait
Kedges Straits
Pt. Lookout
Cove Pt
Deep Water Pt
Maurice River
Indian R. Inlet
Indian R. Bay
Choptank River
Nanticoke River
Pocomoke
Patuxent River
POTOMAC RIVER
ARMY CHEMICAL CENTER
ABERDEEN PROVING GROUND
PATUXENT RIVER NAVAL AIR TEST CENTER
CANAL
Greenwich
2581
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4
5
6
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8
9
45'
30'
15'
39°
38°

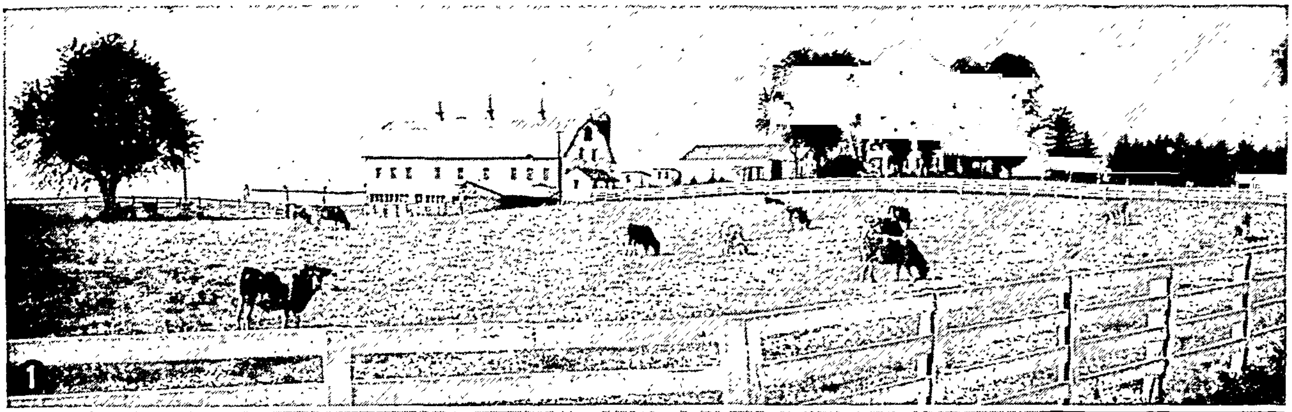
MARYLAND—*Continued*

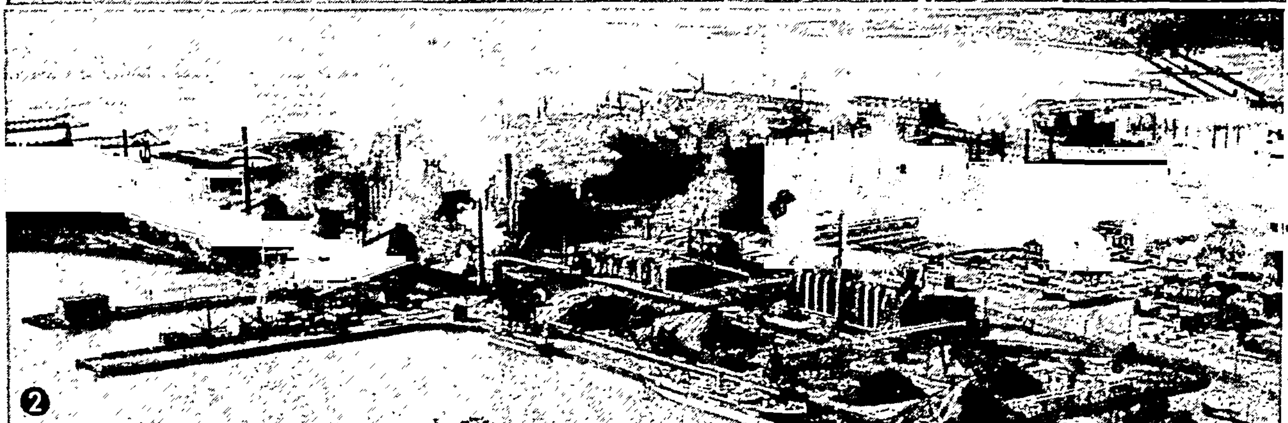
Landover Hills	1,661	C 4
Lanham	1,133	C 4
Lansdowne	7,500	H 3
Lantz	75	E 2
Largo	100	C 5
Lauraville		H 3
Laurel	4,482	G 4
Lawsonia	800	L 9
Laytonsville	132	F 4
Le Gore	400	E 2
Leeds	40	L 2
Leitersburg	250	D 2
Leonardtown	1,017	H 7
Leslie		L 2
Level	450	K 2
Lewistown	350	E 2
Lexington Park	6,000	J 7
Liberty Grove	210	K 2
Libertytown	600	E 3
Lime Kiln	185	E 3
Linden	1,000	A 4
Lineboro	200	G 2
Linkwood	125	L 6
Linthicum Heights	3,500	H 4
Linwood		F 2
Lisbon	150	F 3
Little Orleans	300	A 2
Loch Lynn Hts.	415	A 8
Lonaconing	2,289	C 7
Long Green	500	H 3
Lothian	100	H 5
Love Point	120	J 4
Loveville	500	H 7
Lower Marlboro	135	H 6
Luke	820	B 8
Lusby	225	J 7
Lutherville	2,800	H 3
Lynch	97	K 3
Mackall	41	H 7
Madison	360	K 6
Madonna	25	H 2
Magnolia	500	J 3
Manchester	1,027	G 2
Manokin	400	L 8
Mapleville	175	D 2
Marbury		F 6
Mardela Sprs.	428	L 7
Marion Sta.	475	M 8
Marshall Hall	50	F 6
Marydel	110	L 4
Maryland Line	202	H 2
Maryland Pk.	1,500	C 5
Mason Springs	50	F 6
Massey	125	L 3
Maugansville	725	D 2
Mayberry	108	F 2
Mayo	583	H 5
McDaniel	197	J 5
Meadows	350	C 5
Mechanicsville	500	H 7
Medford	125	F 2
Melitota	100	K 4
Melrose	150	G 2
Middle River	27,500	J 3
Middleburg	150	F 2
Middletown	936	E 3
Midland	889	C 7
Milestown	400	H 7
Millers	225	G 2
Millersville	250	H 4
Millington	356	L 3
Monie	250	L 8
Monkton	105	H 2
Monrovia	112	E 3
Montrose	200	A 3
Morningside	1,520	C 5
Moscow Mills	300	B 7
Mount Airy	1,061	F 3
Mount Lena	150	D 2
Mount Pleasant		E 3
Mt. Rainier	10,989	B 4
Mt. Savage	2,094	C 7
Mt. Vernon	400	L 8
Mt. Washington	4,153	H 3
Mountain Lake Park	891	A 8
Mountaindale	175	E 2
Muirkirk	400	G 4
Mullinix Mill	25	F 3
Myersville	250	D 3
Nanjemoy	264	F 7
Nanticoke	650	L 7
National	348	C 7
Neavitt		J 6
New Glatz	50	B 6
New Market	301	E 3
New Windsor	707	F 2
Newark	500	N 7
Newport		G 7
Nikep	275	C 7
Norbeck	500	F 4
Norrisville	100	J 2
North Beach	314	J 6
North Branch	280	D 7
North Brentwood	833	B 4
North East	1,517	L 2
Oakland	1,640	A 8
Ocean City	1,234	O 7
Odenton	1,059	H 4
Oella	1,500	G 3
Oldtown	500	D 7
Olivet	250	J 7
Olney	1,000	F 4
Orangeville	300	H 3
Oraville	300	H 7
Oriole	268	L 8
Owings	230	H 6
Owings Mills	1,500	G 3
Oxford	757	K 6
Oxon Hill	280	B 6
Palmers	300	H 8
Park Hall	400	J 8
Parkton	500	H 2
Parkville		H 3
Parole	1,032	H 5
Parran		H 6
Parsonsburg	350	M 7
Pasadena	1,500	H 4
Patapsco		G 2
Perry Hall	1,000	H 3
Perryman	300	K 3
Perryville	679	K 2
Petersville	250	D 3
Phoenix	150	H 2
Pikesville	15,000	G 3
Piney Point	1,000	H 8
Pinto	275	C 7
Piscataway	77	G 6
Pisgah	450	F 6
Pittsville	497	N 7
Pleasant Valley	170	G 2
Plum Point		J 6
Pocomoke City	3,191	M 8
Point of Rocks	361	E 3
Pomfret	500	G 6
Pomona	35	K 4
Pomonkey	200	F 6
Poolesville	161	E 4
Popes Creek	75	G 7
Port Deposit	1,139	K 2
Port Republic	50	J 6
Port Tobacco	125	F 6
Port Tobacco Sta. (Springhill)	150	G 7
Potomac	250	F 4
Powellville	350	N 7
Preston	353	L 6
Price	245	L 4
Prince Frederick	500	H 6
Princess Anne	1,407	L 8
Principio Furnace	250	L 2
Providence	300	L 2
Purdum	175	E 3
Quantico	250	M 7
Queen Anne	396	K 5
Queenstown	316	K 5
Randallstown	1,550	G 3
Rawlings	500	C 7
Reid	50	D 2
Reids Grove	45	L 6
Reisterstown	1,500	G 3
Relay	1,000	H 4
Reliance	30	L 6
Revell	100	J 4
Rhodes Point	150	K 9
Riderwood		H 3
Ridge	400	J 8
Ridgely	834	L 5
Ridgeville	150	F 3
Ringgold	212	D 2
Rising Sun	668	K 2
Ritchie	200	C 5
River Springs	300	G 8
Riverdale	5,530	B 4
Riverside	150	F 7
Rock Hall	786	K 4
Rock Point	200	G 7
Rocks		J 2
Rockville	6,934	F 4
Rogers Heights	2,000	C 4
Rohrersville	165	D 3
Roland Park	12,000	H 3
Rosaryville	100	G 5
Rosedale		H 3
Rowlandsville		K 2
Royal Oak		K 6
Rumbley	113	L 8
Ruthsberg	25	L 4
Rutland	300	H 5
Ruxton		H 3
Sabillasville	300	E 2
St. Augustine	50	L 3
St. Inigoes	400	J 8
St. James	100	C 2
St. Leonard		J 7
St. Martin's		O 7
St. Michaels	1,470	J 5
Salem	42	L 7
Salisbury	15,141	M 7
Sandy Spring	650	F 4
Sassafras	100	L 3
Savage	1,238	G 4
Savage Station	25	G 4
Scotland	300	J 8
Seabrook	2,500	C 4
Seat Pleasant	2,255	C 5
Secretary	344	L 6
Security	300	D 2
Severn	250	H 4
Severna Pk.	1,000	H 4
Sharpsburg	866	C 3
Sharptown	680	M 6
Shawsville	50	H 2
Shelltown	28	M 9
Shipley	1,500	H 4
Showell	100	O 7
Silver Hill	1,000	B 5
Silver Run	325	F 2
Silver Spring	75,000	B 4
Smallwood	160	F 2
Smithsburg	641	D 2
Snow Hill	2,091	N 8
Solomons	270	J 7
Somerset	430	A 4
Sparrows Point	12,000	J 4
Spickler	85	C 2
Spielman	202	C 2
Springhill	150	G 7
Stemmers Run	1,260	H 3
Stevensville	350	J 5
Steyer	55	A 8
Still Pond	290	K 3
Still Pond Station	4	K 3
Stockton	500	N 8
Street	200	J 2
Sudlersville	347	L 4
Sudley		H 5
Suitland	2,500	C 5
Swanton	242	A 8
Sweetair	35	H 2
Sykesville	941	F 3
T. B.	100	G 6
Takoma Pk.	13,341	B 4
Taneytown	1,420	F 2
Taylors Isl.	300	J 7
Taylorsville	125	F 3
Templeville	82	L 4
Texas		H 3
Thomas	200	J 6
Thurmont	1,676	E 2
Tilghman	1,250	J 6
Timonium	1,300	H 3
Toddville	330	K 7
Tolchester Beach	4	J 4
Tompkinsville	510	G 7
Town Creek	50	A 2
Town Point	25	L 3
Towson	11,000	H 3
Trappe	325	K 6
Trappe Station	35	K 6
Trenton	100	G 2
Tunis Mills	100	K 5
Tuxedo	1,000	C 5
Tyaskin	150	L 7
Union Bridge	840	F 2
Union Mills	300	F 2
Uniontown	265	F 2
Unionville	150	F 3
Unity	82	F 4
University Park	2,205	B 4
Upper Fairmount	824	L 8
Upper Falls	200	J 3
UpperMarlboro	702	H 5
Upperco	150	G 2
Urbana		E 3
Vale Summit	450	C 7
Valley Lee	300	H 8
Venton	100	M 8
Vienna	414	L 7
Vindex	175	B 8
Waldorf	1,100	G 6
Walkersville	761	E 3
Warwick		L 3
Washington Grove	400	F 4
Waterview	50	L 8
Welcome	200	F 7
Wenona	300	L 8
West Annapolis		H 4
West Lanham Hills	1,200	C 4
West River		H 5
Westernport	3,431	B 8
Westminster	6,140	G 2
Westover	400	M 8
Wetipquin	500	L 7
Weverton	150	D 3
Whaleysville	350	N 7
Wheaton	20,000	A 3
White Hall	300	H 2
White Marsh	500	J 3
White Oak	50	B 3
White Plains	700	G 6
Whiteford	300	J 2
Whitehaven	95	L 7
Wicomico	225	G 7
Willards	464	N 7
Williamsburg	150	L 6
Williamsport	1,890	C 2
Williston	100	L 5
Willows	40	H 6
Winfield		F 3
Wingate	430	K 7
Wittman	225	J 5
Wolfsville	96	D 2
Woodbine		F 3
Woodlawn	5,000	H 3
Woodmoor	500	B 4
Woodsboro	427	E 2
Woodside	3,500	B 4
Woodstock	100	G 3
Woolford	150	K 7
Worton	150	K 3
Wye Mills	125	K 5
Wye Mills Sta.	100	K 5
Wynne	300	J 8
Yellow Springs		D 3
Zion		L 2

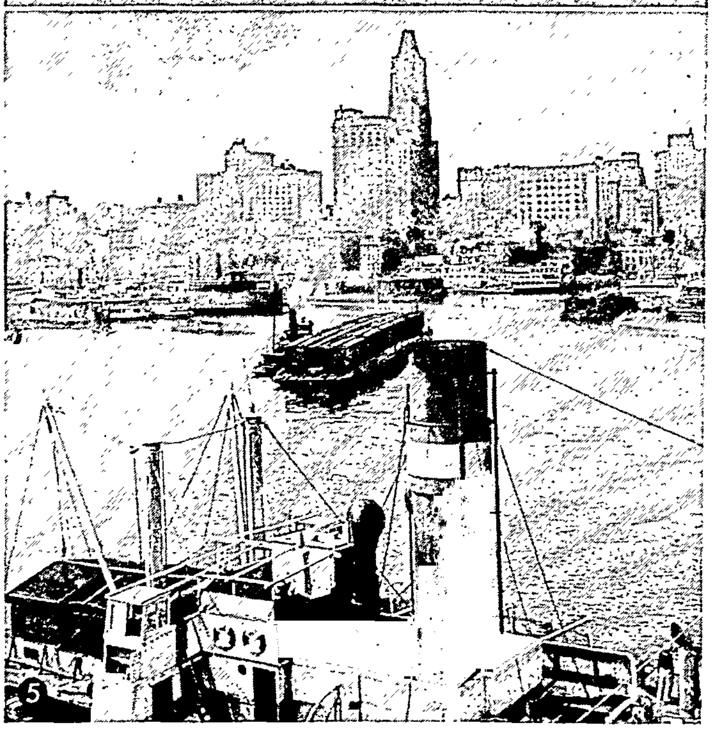
DIST. OF COLUMBIA

Anacostia		B 5
Benning		B 5
Brightwood		B 4
Brookland		B 4
Cleveland Park		A 4
Congress Heights		B 5
Georgetown		A 5
Petworth		B 4
Tenleytown		A 4
WASHINGTON, D. C.	802,178	B 5

SOURCES OF MARYLAND'S WEALTH

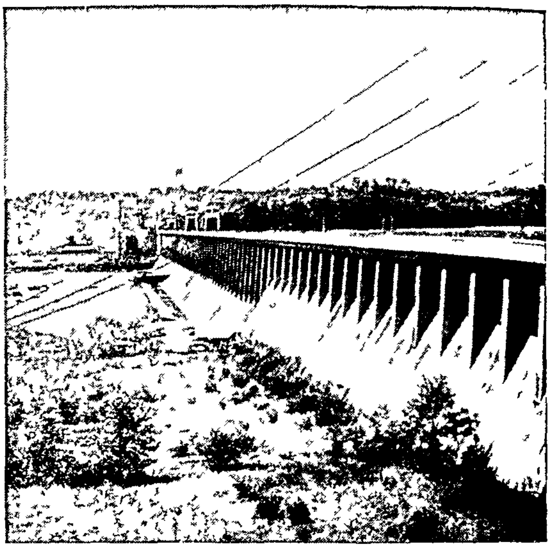




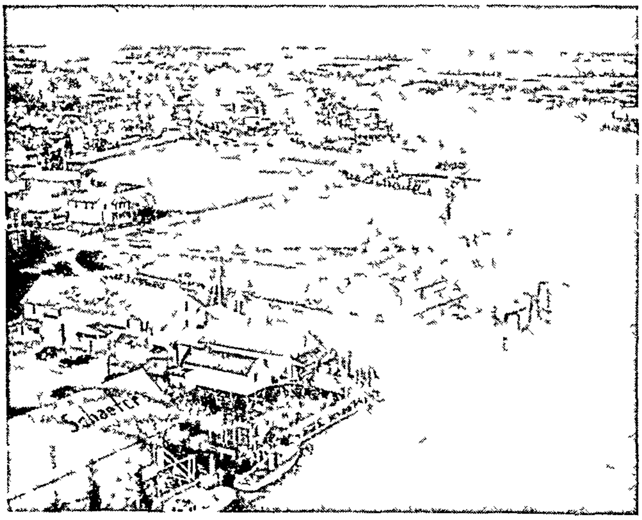


1. Dairying is one of the most important sources of farm income in the state. 2. The Bethlehem Steel Company has the world's largest tidewater steel plant at Sparrows Point. 3. These fishermen are tonging and culling oysters in one of the many inlets along the eastern shore of Chesapeake Bay. 4. Canneries are part of Maryland's great sea-food and vegetable industries. 5. Beyond Baltimore's busy harbor is the sky line of the business district of Maryland's largest city.

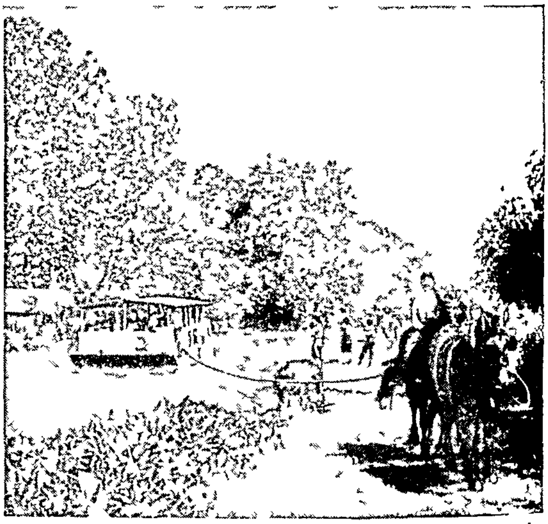
About 15 miles above Washington are the Great Falls of the Potomac, a series of wild rapids and cascades in a long gorge.



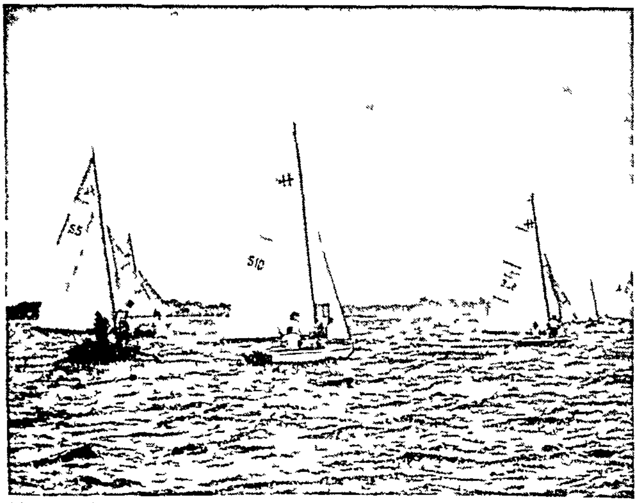
Conowingo Dam across the Susquehanna in northeastern Maryland is one of the largest privately owned hydroelectric plants.



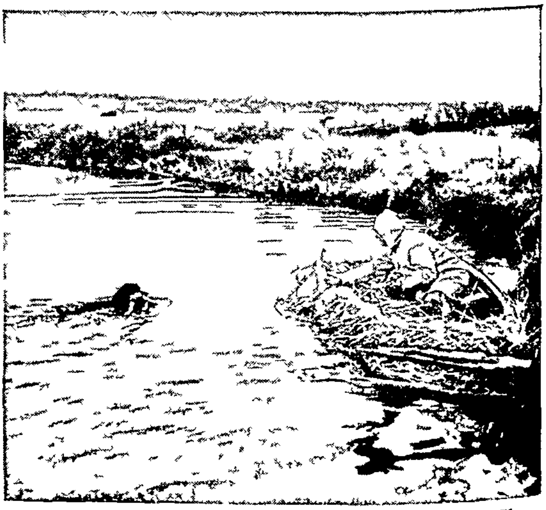
At Chesapeake, Md , the Chesapeake and Delaware Canal flows by. The canal connects the Chesapeake and Delaware bays.



Plodding mules tow a boatload of sight-seers on the Chesapeake and Ohio Canal built 1828–50 in the Potomac River valley.



Chesapeake Bay is one of the nation's favorite sailing waters, as shown by this fleet on the wide Choptank, an arm of the bay.



Chesapeake Bay is noted for its waterfowl hunting and the Chesapeake Bay retriever, a dog breed developed in the bay region.

for the writing of 'The Star-Spangled Banner' by Francis Scott Key (*see* Key; War of 1812). The first line of electric telegraph in the United States was run from Baltimore to Washington, D. C., in 1844 (*see* Morse; Telegraph). Maryland's sympathies during the Civil War were divided, but though a slave-holding state it adhered to the Union. The battle of Antietam took place on its soil (*see* Antietam, Battle of). A new constitution adopted in 1864 abolished slavery. (For additional history, *see also* chronology in Maryland Fact Summary.)

Many Distinguished Citizens

Maryland has a long roster of distinguished citizens. Margaret Brent, heir and executrix of Gov. Leonard Calvert, was a pioneer suffragist, who asked permission to vote in the Assembly but was denied it (*see* Women's Rights). James Rumsey, a native of Cecil County, invented a pump-driven steamboat which made a trial trip at Harpers Ferry more than 20 years before Robert Fulton launched the first wholly successful steamboat on the Hudson River in 1807. Stephen Decatur, the great naval commander, was a native of Worcester County (*see* Decatur).

One of the world's great actors, Edwin Booth, was a native of Harford County. The last living signer of the Declaration of Independence, Charles Carroll, was a native of Maryland. Mason Weems, born in Anne Arundel County, was the biographer of George Washington, who first wrote the story of the youthful Washington, the hatchet, and the cherry tree. Charles Wilson Peale, who made several fine portraits of Washington, was a leading painter of the Revolutionary War period.

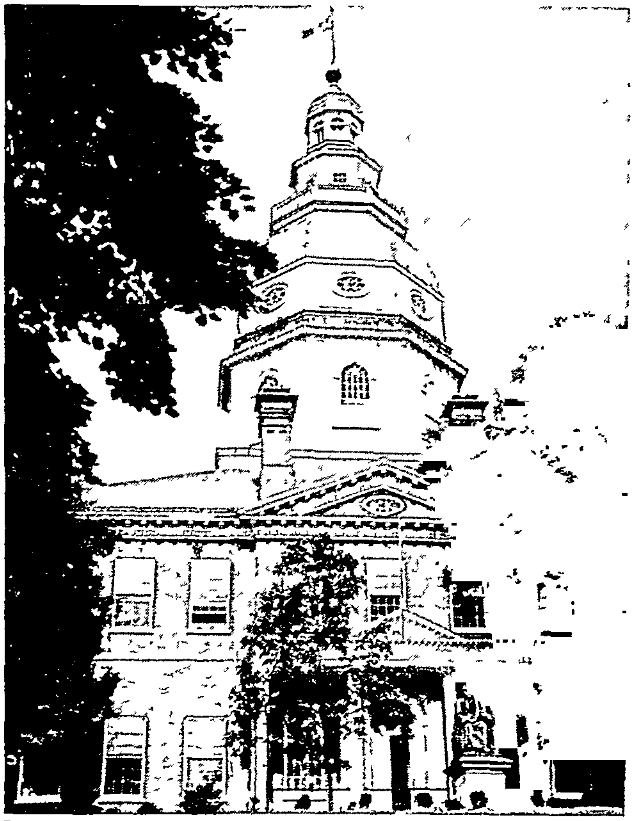
James Ryder Randall, a native of Baltimore, wrote 'Maryland, My Maryland' when he read that the Sixth Massachusetts Infantry had been attacked while marching through the streets of Baltimore. Maryland has adopted the song as the state anthem.

Maryland men of wealth have given generously of their money for libraries and educational institutions. George Peabody not only saved the credit of Maryland during the financial stress of 1836, but later endowed various public institutions. Johns Hopkins, a native of Anne Arundel County, left an estate of $7,000,000 in 1873 to found the famous university in Baltimore which bears his name. The first school for graduate study in America was started here in 1876, and the university did much to transform American training in medicine. Pratt Library in Baltimore is named after Enoch Pratt, a wealthy merchant, who gave over a million dollars to found it.

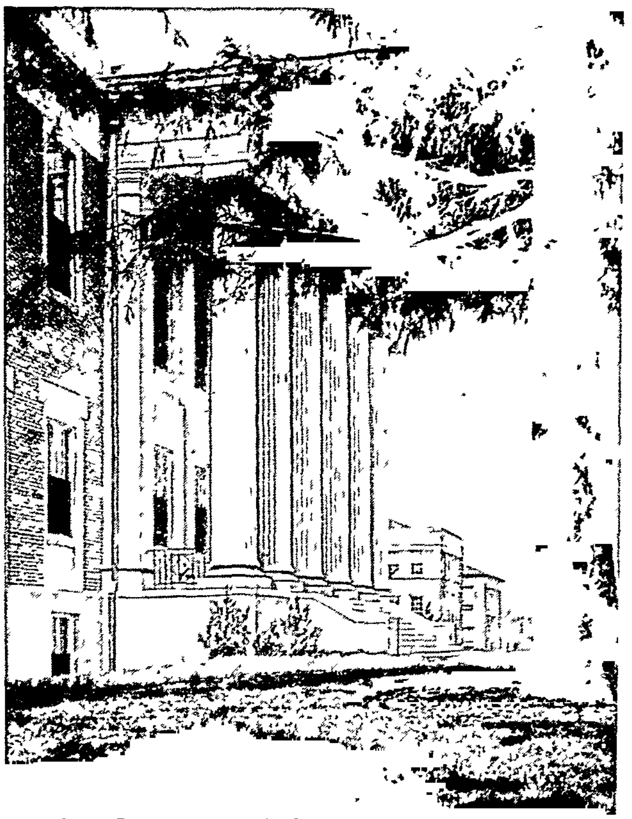
Edgar Allan Poe, the famous writer, lived in Baltimore for several years (*see* Poe). Teachers and pupils of the city have erected a monument to him in Westminster Churchyard. The poet Sidney Lanier was a flutist in the Peabody Symphony Orchestra in Baltimore and lecturer at Johns Hopkins University (*see* Lanier). Maryland also claims F. Hopkinson Smith, novelist, and Henry L. Mencken, critic and essayist.

Roger Brooke Taney, chief justice of the United States Supreme Court which handed down the Dred

LAW AND LEARNING IN MARYLAND



Maryland's State House at Annapolis is the oldest (1772) state capitol in daily use. Here Washington resigned as commander in chief and the Treaty of Peace with Britain was signed.



At College Park are the dignified Georgian Colonial buildings of the University of Maryland. Its College of Agriculture and College of Engineering and Aeronautical Science are famous.

Scott Decision, and Winfield Scott Schley, second in command at Santiago in the Spanish-American War, were native sons (*see* Taney; Dred Scott Decision). Mrs. Wallis Warfield Simpson, who became Duchess of Windsor when Edward VIII of Great Britain abdicated to marry her, was born in Baltimore.

Important in Education

Maryland has notable educational institutions. At Annapolis are St. John's College, founded in 1696 as King William's School and chartered in 1785, and the United States Naval Academy (*see* Naval Academy).

Baltimore has Johns Hopkins University, famous for its medical and scientific schools; Goucher College, a women's college founded in 1885; and Peabody Institute, noted for its Conservatory of Music.

The University of Maryland is located at College Park and Baltimore. State teachers colleges are located at Towson, Frostburg, Salisbury, Bowie, and Baltimore (Coppin). (*See also* United States, sections "The South" and "Middle Atlantic Region.")

MASARYK (*mä'sȧ-rĭk*), THOMAS GARRIGUE (1850–1937). The founder and first president of the Czechoslovak republic was a professor who had known tyranny from boyhood. Masaryk was born March 7, 1850, in Hodonin, near the Moravian border. His father was a coachman on one of the Austrian imperial estates, his mother a former servant. Even as a child he saw and hated the great barrier between nobility and peasants.

The boy dreamed of being a teacher. But his parents could not afford advanced schooling. They apprenticed him to a locksmith and later to a blacksmith. Then a former teacher helped him enter a school at Brno, where he could support himself by tutoring students. From the age of 15 he made his own way.

He finished high school in Vienna, and entered the University of Vienna in 1872. At Leipzig, where he took postgraduate studies, he met Charlotte Garrigue, an American girl. They were married in 1878, and Masaryk added her name to his.

In 1882 Masaryk became professor of philosophy at the Czech University in Prague. He began writing and teaching to unite the Czechs and the Slovaks into a nation. He entered politics and served in the Austrian parliament 1891–93 and 1907–14. He was a visiting professor at the University of Chicago in 1903–4.

When war broke out in 1914, Masaryk seized the opportunity to unite Czechs to fight for independence. He toured Allied countries, organizing Czechs who had fled their homeland or who were prisoners of war. In 1918 the Czech National Assembly made him president, and in 1920 the people elected him to office by popular vote (*see* Czechoslovakia).

Masaryk governed until 1935 when he retired in favor of Eduard Benes. He died in 1937. His son Jan held high offices in the Czech government, but died from a fall when the Communists came into power in 1948.

MASCAGNI (*mäs-kän'yē*), PIETRO (1863–1945). In the Italian village of Cerignola, near Foggia, a young piano teacher, Pietro Mascagni, worked against time to compose a one-act opera. A nationwide opera competition was about to close. Mascagni finished at the last minute and hurriedly submitted his work. His opera 'Cavalleria Rusticana' (Rustic Chivalry) was awarded the prize. It was produced in Rome in 1890 and won young Mascagni world fame.

Mascagni was born in Livorno, Italy, the son of a baker. Against his father's wishes, Pietro studied piano secretly. His father found out and forbade the boy to play. But a sympathetic uncle adopted him and encouraged him to go on with music. His father realized that the boy had talent and allowed him to return home and continue his studies. An Italian nobleman sent him to the Milan Conservatory. But he ran away and joined a small opera company. For several years he toured with opera companies, usually as a conductor. Then he settled in Cerignola to teach piano.

'Cavalleria Rusticana' was performed in European capitals and in New York. Mascagni wrote several more operas, but none was so successful as his first. 'Iris' was presented in New York City in 1902, with Enrico Caruso in the leading rôle. His last opera 'Il Nerone' (Nero) was sung at La Scala in Milan in 1935. Mascagni was popular as a conductor and often directed his own works. He died in Rome in 1945.

MASEFIELD, JOHN (born 1878). In 1902 John Masefield wrote these haunting and nostalgic lines in his poem 'Sea Fever':

> I must go down to the sea again, to the lonely
> sea and the sky,
> And all I ask is a tall ship, and a star to steer her by.

He was remembering the sailor's life he had given up to become a writer. Nor did he ever forget the days at sea. He returned to them again and again in his poems and stories. He wrote about the land too, about fox hunting and racing and outdoor life. Masefield told about these typically English things so well that he was chosen England's poet laureate.

Masefield was born June 1, 1878, in Ledbury, Herefordshire. After his father's death, an uncle reared him. Young Masefield wanted to be a merchant marine officer. At 13 he boarded the training ship *Conway* moored in the river Mersey. After two and a half years at the school ship he was apprenticed aboard a windjammer bound for Chile by way of Cape Horn.

But at Chile he became ill and had to return to England by steamer. After he recovered he went to New York City to take a berth aboard a liner. In New York he suddenly decided to give up the sea. He went ashore and worked for three years, chiefly in a carpet factory in Yonkers. After work he read constantly.

In 1897 he returned to England determined to succeed as a writer. He worked on newspapers at first, and in 1902 published his first volume of poems 'Salt-Water Ballads'. Then he wrote steadily—poems, stories, and plays. In 1903 he married Constance de la Cherois-Crommelin. They had two children.

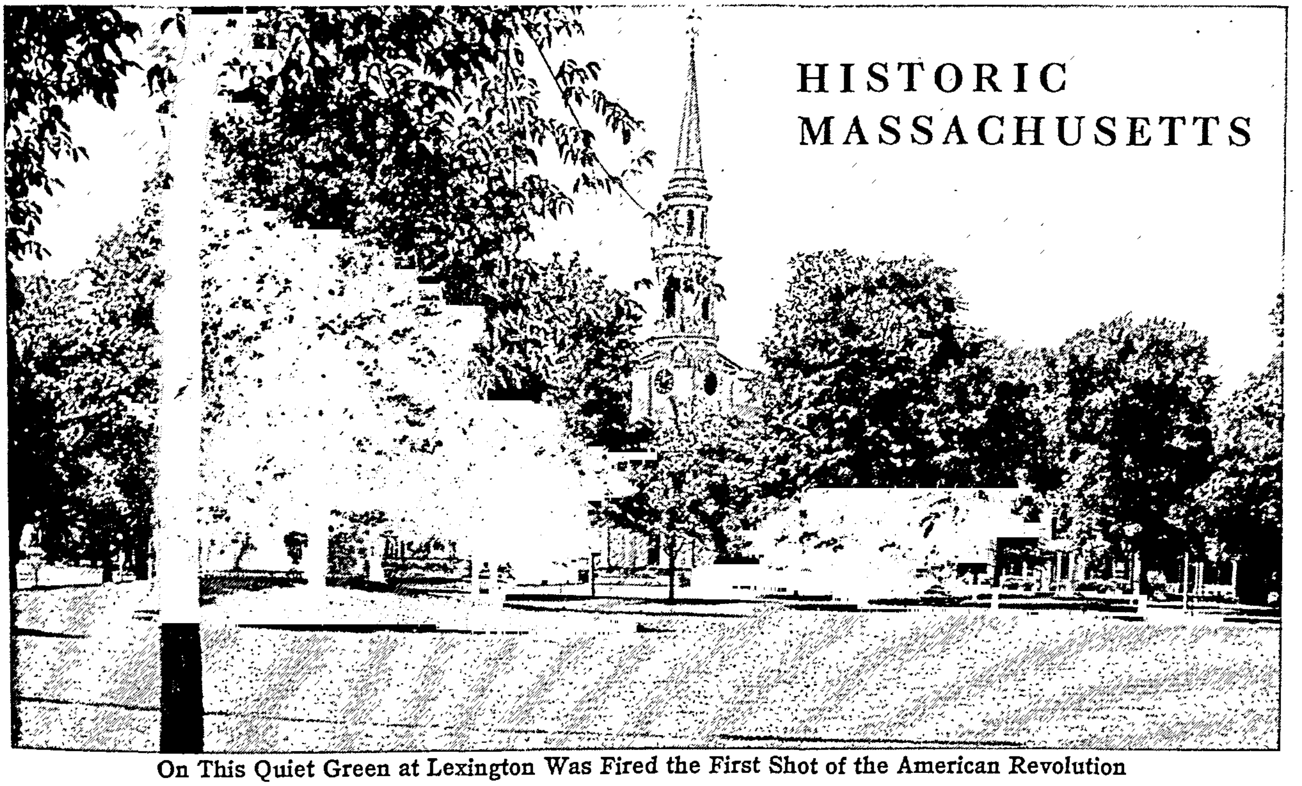
In the first World War Masefield served in the Red Cross in France and on a hospital ship at Gallipoli. His book 'Gallipoli' (1916) was an account of that campaign. After the war he settled at Boar's Head, near Oxford. He was appointed poet laureate in 1930. In all, Masefield wrote more than one hundred books.

MASON AND DIXON'S LINE. The original Mason and Dixon's Line was the boundary between Maryland and Pennsylvania. This boundary was the subject of a dispute between the two colonies for nearly a century. Both colonies claimed the area between the 39th and 40th parallels, a strip about 40 miles wide.

It was not until 1760 that the two states agreed on a general boundary. According to the agreement the boundary was to be surveyed from a base line running due west from Cape Henlopen to Chesapeake Bay. From the middle of this base line another line was to run north to form a tangent to the western arc of a circle having a radius of 12 miles from New Castle (now in Delaware). From the tangent point, the line was to be drawn due north until it intersected a parallel of latitude 15 miles south of Philadelphia, a parallel later determined to be about 39° 43′. The boundary was then to run due west from this point of intersection to the Mississippi River.

The men who began to survey the lines in 1760 were slow. The colonies sent for two English mathematicians, Charles Mason and Jeremiah Dixon, to complete the work. Mason and Dixon began their survey in 1763. Four years later, when they had determined the boundary to a point about 30 miles west of the northwest corner of Maryland, Indians stopped them.

Part of the line was marked by stones, bearing on one side the arms of Lord Baltimore and on the other those of Penn. Some of these still stand. When slavery was abolished in the states north of Mason and Dixon's line and prohibited in territory north of the Ohio River, the name of "Mason and Dixon's line" was popularly given to an extension of the original boundary. This extension followed the Ohio River to Missouri, then around the southern part of Missouri, and westward along the parallel of 36° 30′ (*see* Missouri Compromise). "Dixie," a name for the South, may have come from "Dixon's line."



On This Quiet Green at Lexington Was Fired the First Shot of the American Revolution

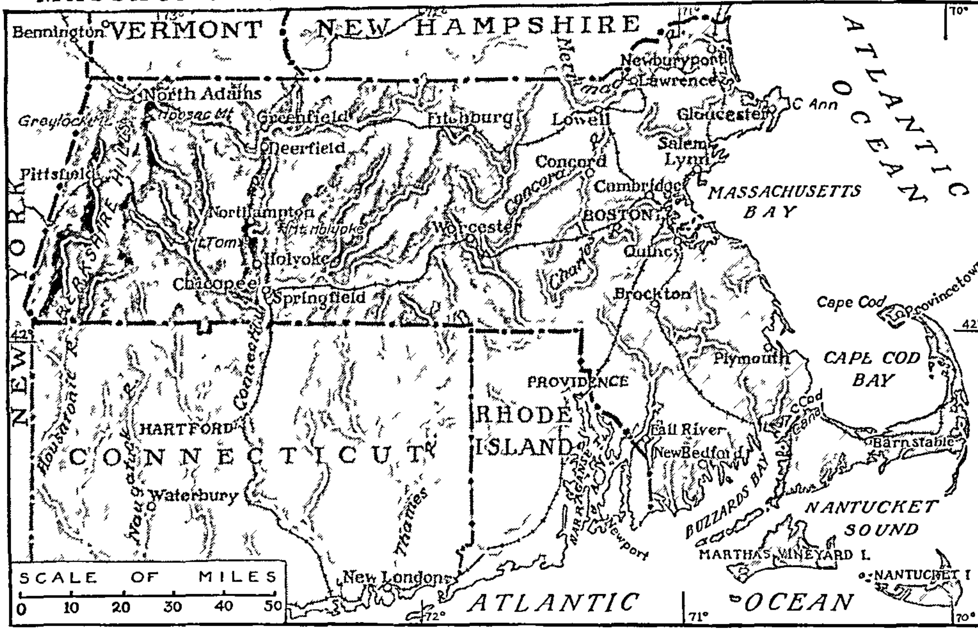
MASSACHUSETTS. The wave-battered coast of Massachusetts turns a hard face to the sea. Rugged cliffs or low sand dunes mark much of the coast line, and the North Atlantic hurls many a storm at the entire shore. Skill and courage were needed before men could establish ways of winning a living along this coast.

In colonial times, the land behind the coast was scarcely less grim. Most of it was rocky and rolling or even mountainous, and all of it was covered with forest. Some patches of land were level and fertile, and farming was possible after the trees had been cleared. But all too much of it was a thin skin of soil over unproductive glacial boulders and gravel.

Now the entire appearance has been changed. The once grim coast line has been transformed into an inviting strip of resort land, sought by visitors from all over the nation. The countryside is trim and smiling in summer, and dotted with busy factory cities and neat villages. But the change was not easy. It took unflagging effort and rare determination on the part of a sturdy folk who would not accept defeat. The story of their effort is at the heart of everything which made the Massachusetts of today.

The coast is a treasure house of history. The Pilgrims in 1620 first anchored near Provincetown at the tip of the Cape Cod peninsula. Their settlement was across the bay at Plymouth (*see* Plymouth). A few

MASSACHUSETTS AND ITS "SEAGOING" COAST LINE



The winding and indented shore gave the settlers of Massachusetts many good harbors. Shipbuilding and a world-wide sea commerce flourished at an early date. Then the many streams shown on the map became a later factor of wealth. They supplied the power for prosperous mill industries.

miles to the north, at Duxbury, John Alden and Miles Standish built their homes. In Quincy, Boston, Salem, Marblehead, and Gloucester, the story of the 17th century may still be read in old houses, old street names, old tombstones (*see* Boston).

The place names too have their story to tell. Some, like Boston and Plymouth, tell of ports back in England; others, like Salem—which is another name for Jerusalem—remind you of the religious fervor which first brought Englishmen to these shores. Cambridge recalls that beautiful English town in whose university some of Massachusetts' early settlers had studied. Between 1630 and 1650 more than 70 Cambridge graduates joined the colony. Among them were Roger Williams, John Eliot, and John Harvard—the last the founder of the famous university that bears his name in the new-world Cambridge (*see* Cambridge). Other place names commemorate colonial celebrities, while still others are from the Indian tongue. The name Massachusetts itself comes from Indian words meaning "near the great mountain." The state was named for the Massachuset tribe, which once lived between Salem and Plymouth.

Now history-book Massachusetts has become a modern industrial state of great factories and bustling commerce. A great majority of the people live in cities or towns. The shoe cities, especially Brockton, Haverhill, and Lynn, turn out about a fifth of the nation's shoes. Boston's leading manufactures are food products, clothing, and machinery. Holyoke and Springfield make a large part of our fine writing papers (*see* Springfield). Lowell, Lawrence, New Bedford, and Fall River are textile centers (*see* articles on each of these cities). The last two were long the greatest "mill towns" in the country.

Today the South competes with New England in cotton manufacture, but Massachusetts still is a big producer of cotton goods as well as the first state in the manufacture of woolens. Worcester was the home of men who invented looms, wire-drawing processes, machine tools, and a planing machine. Now it specializes in industrial machinery and tools (*see* Worcester). In Waltham is one of the largest watch factories in the world. Tanning and finishing leather is Woburn's chief industry; Gloucester, the great fishing port, has over 20 fish-processing plants; Quincy has granite quarries and shipyards. Other important industrial cities are Pittsfield, Chicopee, Everett, and Salem.

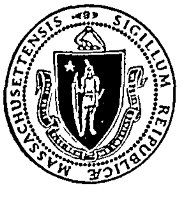
The Industries and the Foreign Population

Massachusetts has attracted a great many foreign workers with its wealth. Even today about 15 per cent of the white inhabitants of the state are foreign born. In certain parts of the state are whole villages of French Canadians, workers in the cotton mills. The Italians employed in the cordage industry at Plymouth form a community of their own, that crowds closely this historic town of the Pilgrims. Many Portuguese earn their living in the fishing and cranberry industries of Cape Cod. Swedes and Finns work the granite quarries of Cape Ann. In Salem you would perhaps find a Polish family living in the house once owned by the man who first sent ships from America to India and China around the Cape of Good Hope. Where Paul Revere lived in Boston is now Little Italy. Most numerous are the Canadians, the Irish, and the Italians. The rigidity of 17th-century Puritanism long ago disappeared from Massachusetts' life, and with this influx of foreign immigration the religious balance has passed from Protestantism to Roman Catholicism.

Massachusetts has always been one of the richest states in the Union. Its wealth of late years comes chiefly from manufactures, but its early prosperity came from its fisheries. During their first winter, 51 of the Mayflower colonists died, and the rest would hardly have survived without the wholesome food caught off their shores. By 1633 the colonists had begun exporting fish. As the industry developed, their ships carried abroad the cod and mackerel

Continued on page 135

Massachusetts Fact Summary



MASSACHUSETTS (Mass.): From Algonquian Indian words, *Mass-adchu-set*, for "near the great mountain."

Nickname: "Bay State," from the early settlement on Cape Cod Bay. "Old Colony State," referring to part of state that was originally Plymouth Colony. Also "Puritan State."

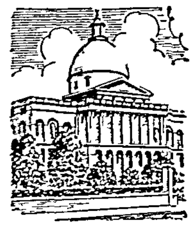
Seal: An Indian and star on a shield. On the crest a wreath supports a bent arm; the hand holds a sword.

Motto: Ense Petit Placidam Sub Libertate Quietem (By the Sword This Hand Seeks Peace, but Peace Only under Liberty).

Flag: For description and illustration, *see* Flags.

Flower: Mayflower. **Bird**: Chickadee. **Tree**: American elm. **Song**: None official.

THE GOVERNMENT



Capital: Boston (since 1632, when made colonial capital).

Representation in Congress: Senate, 2; House of Representatives, 14. Electoral votes, 16.

General Court: Senators, 40; term, 2 years. Representatives, 240; term, 2 years. Convenes 1st Wed. in January annually. No limit to regular or special sessions.

Constitution: Adopted 1780. Proposed amendment must be (a) passed by a majority of members elected to 2 successive General Courts, or by an initiative petition of the people which receives a vote of one fourth of all members of 2 successive General Courts, and (b) ratified by majority voting on amendment.

Governor: Term, 2 years. May succeed himself.

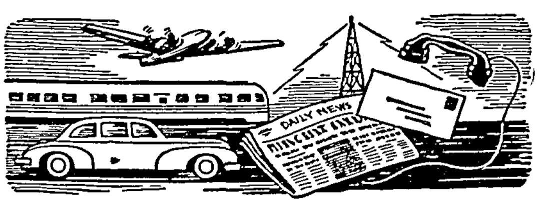
Other Executive Officers: Lieut. governor, 8 councilors, secy. of commonwealth, attorney general, treasurer and receiver general, auditor; all elected; terms, 2 years.

Judiciary: Supreme judicial court—7 justices. Superior courts—32 judges; sittings in each county. Probate courts—1 to 3 in each county. Governor, with approval of executive council, appoints all judges for life.

County: 14 counties; 13 governed by board of 3 commissioners elected for 4 years; in Suffolk County, members of City Council of Boston are county commissioners.

Municipal: Mayor-council and city-manager plans. Towns elect 3 or 5 selectmen and other officers.

Voting Qualifications: Age, 21; residence in state, 1 year; in city or town, 6 months. Literacy test required.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 1,700 miles. First railroad, from Quincy to Milton, 1826. Rural roads, 17,800 miles. Airports, 74.

Communication: Periodicals, 197. Newspapers, 288. First newspaper, *Publick Occurrences* (1 issue only), 1690, Boston; *Boston News-Letter*, 1704, Boston. Radio stations (AM and FM), 72; first station, WBZ, East Springfield, licensed Sept. 15, 1921. Television stations, 6; first station, WBZ-TV, Boston, began operation June 9, 1948. Telephones, 1,762,000. Post offices, 569.

THE PEOPLE AND THEIR LAND

Population (1950 census): 4,690,514 (rank among 48 states—9th); urban, 84.4%; rural, 15.6%. Density: 596.2 persons per square mile (rank—3d state).

Extent: Area, 8,257 square miles, including 390 square miles of water surface (44th state in size).

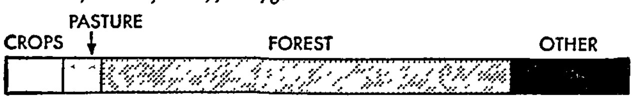
Elevation: Highest, Mount Greylock, 3,491 feet, near Adams; lowest, sea level.

Temperature (°F.): Average—annual, 48°; winter, 28°; spring, 46°; summer, 68°; fall, 52°. Lowest recorded, −30° (West Cummington and Turners Falls, Feb. 16, 1943); highest recorded, 106° (Lawrence, July 4, 1911 and other locations and earlier dates).

Precipitation: Average (inches)—annual, 43; winter, 10; spring, 11; summer, 11; fall, 11. Varies from about 48 inches in portions of the Berkshires and east central to about 38 inches in extreme northeast.

Natural Features: Coastal lowlands in eastern section. The interior lowlands spread through the Connecticut Valley and Berkshire Valley. They are cut by a plateau extending eastward from the Connecticut Valley through center of state to coast. In the west, the Berkshire Hills and Hoosac Range. Chief rivers: Blackstone, Charles, Connecticut, Housatonic, Merrimack, Mystic, Taunton.

Land Use: Cropland, 9%; nonforested pasture, 6%; forest, 66%; other (roads, parks, game refuges, wasteland, cities, etc.), 19%.



Natural Resources: *Agricultural*—soil suited to cranberries, livestock, and truck crops. *Industrial*—stone, sand and gravel, limestone, clays; fisheries, water power. *Commercial*—harbor at Boston; historic sites attract tourists.

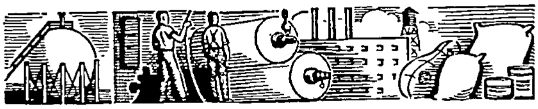
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Manufacturing	682,840	37.5
Wholesale and retail trade	352,720	19.3
Professional services (medical, legal, educational, etc.)	183,091	10.0
Transportation, communication, and other public utilities	127,011	7.0
Construction	100,783	5.5
Personal services (hotel, domestic, laundering, etc.)	95,604	5.2
Government	87,989	4.8
Finance, insurance, and real estate	77,553	4.2
Business and repair services	43,587	2.4
Agriculture, forestry, and fishery	38,914	2.1
Amusement, recreation, and related services	15,155	0.8
Mining	1,453	0.1
Workers not accounted for	20,007	1.1
Total employed	1,826,707	100.0

Massachusetts Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—9th)
Value added by manufacture* (1952), $4,270,674,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
TEXTILE MILL PRODUCTS......... Woolen and worsted fabrics; cotton and rayon broad-woven fabrics	$568,355,000	3
MACHINERY (EXCEPT ELECTRICAL). Textile and metalworking machinery; service and household machines	386,936,000	9
LEATHER AND LEATHER PRODUCTS.. Footwear; tanning, finishing	326,663,000	1
ELECTRICAL MACHINERY.......... Electrical industrial apparatus; radios and related products	256,953,000	6
FOOD AND KINDRED PRODUCTS..... Bakery products; confectioneries.	226,956,000	15
FABRICATED METAL PRODUCTS..... Cutlery, hand tools, and hardware	205,910,000	10

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—39th)
Total cash income (1952), $203,165,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Milk...........	366,000,000 qts.	1	34
Eggs...........	67,000,000 doz.	2	23
Chickens.......	55,958,000 lbs.	3	26
Hay...........	588,000 tons	4	39
Cranberries.....	468,600 bbls.	5	1
Tobacco........	10,353,000 lbs.	6	14
Cattle..........	27,835,000 lbs.	7	44
Potatoes.......	3,214,000 bu.	8	28

*Rank in dollar value †Rank in units produced

C. Fish (Rank among states—2d)
(Marine waters and coastal rivers, 1950), catch, 591,188,000 lbs.; value, $40,767,000

D. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $16,951,000
Rank among states—41st

Minerals (1951)	Amount Produced	Value
Stone..................	3,226,000 tons	$9,172,000
Sand and gravel.........	7,232,000 tons	5,593,000

E. Trade

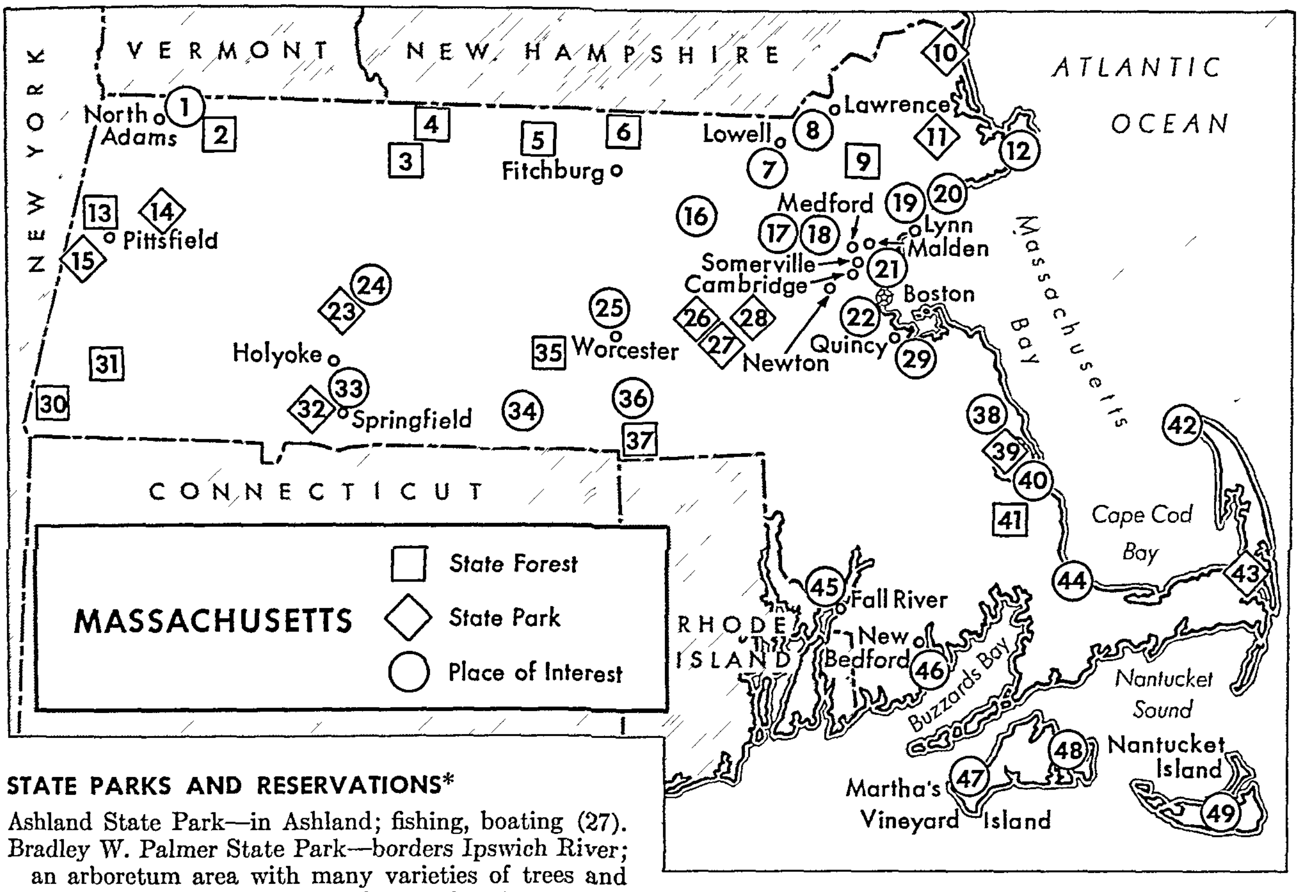
Trade (1948)	Sales	Rank among States
Wholesale.................	$6,534,857,000	9
Retail.....................	4,302,147,000	9
Service....................	441,393,000	9

PLACES OF INTEREST*

Amherst—seat of Amherst College and Univ. of Mass. home of Emily Dickinson built in 1813 (24).
Beverly—at Glover's Wharf first ship of American Navy, schooner *Hannah* was commissioned (1775) (20).
Boston—historic city includes such places as Old North Church, Old South Meetinghouse, Faneuil Hall; State House built in 1795; Dorchester Heights National Historic Site, where American batteries forced British to evacuate Boston (1776) (*see* Boston) (22).
Cambridge—historical, educational, and literary center; Harvard University (1636), first college in U. S.; Massachusetts Institute of Technology (*see* Cambridge) (21).
Concord—famous for literary associations; home of Emerson, Thoreau, Hawthorne, the Alcotts; at Old North Bridge the first exchange of gunfire in the American Revolution took place (1775) (*see* Concord) (17).
Duxbury—Pilgrim village founded by Miles Standish; Alden House, John Alden's home, 1653–87 (38).
Gloucester—famous Cape Ann fishing port and resort; *Fisherman's Memorial honors fishermen lost at sea;* Maritime Museum in old schooner (12).
Hoosac Tunnel—extends 25,000 feet through Hoosac Mountain; built 1851–75 at cost of $20,000,000 (1).
Industrial Centers—(*see* Fall River; Lawrence; Lowell; Lynn; New Bedford) (45, 8, 7, 19, 46).
Lexington—famous battleground on village green (*see* Lexington and Concord, Battle of) (18).
Lowell—Birthplace of Whistler, now art museum (7).
Marblehead—summer resort and yachting center; St. Michael's, Episcopal church erected in 1714; Old Burial Hill; Fort Sewell (1742) at harbor entrance (20).
Martha's Vineyard Island—yachting at Edgarton, island's oldest settlement (1642) (48); colored cliffs and lighthouse (1859) at Gay Head (47).
Nantucket—on Nantucket Island; Whaling Museum, once sperm-oil candle factory; Jethro Coffin House (1686); Museum of Nantucket Historical Assoc. (49).
Plymouth—famous Rock, traditional site of Pilgrim's landing in 1620; imposing National Monument to the Forefathers (*see* Plymouth) (40).
Provincetown—picturesque fishing village and art colony; tower commemorates Pilgrim's landing (42).
Purgatory Chasm—near Sutton; 70-ft. walls rise from great fissure in solid rock; fantastic caves (36).
Quincy—Adams Mansion, home of both John Adams and John Quincy Adams, now national historic site (29).
Salem—city immortalized by Hawthorne; landmarks include House of Seven Gables, Witch House, Hawthorne's birthplace; Essex Institute; Peabody Museum; Salem Maritime National Historic Site includes Derby Wharf and other memorials (20).
Sandwich—Cape Cod town settled 1637; famous for Sandwich glass, made by secret formula in 1800's (44).
Saugus—first producing iron works in New World built 1643; American steel industry birthplace; near (19).
Springfield—many places of interest including several fine museums (*see* Springfield) (33).
Sturbridge—rebuilt 18th-century New England town in 500-acre tract; many original buildings (34).
Wayside Museums—4 museums near Harvard: "Fruitlands," Alcott's experimental community; Shaker Museum, relics of Shaker colony; American Indian Museum, life-size Indian figures; Gallery of Portraits of Old-Time Itinerant Portrait Painters (16).
Worcester—fine library in American Antiquarian Society; art museum (*see* Worcester) (25).

*Numbers in parentheses are keyed to map.

Massachusetts Fact Summary



STATE PARKS AND RESERVATIONS*

Ashland State Park—in Ashland; fishing, boating (27).

Bradley W. Palmer State Park—borders Ipswich River; an arboretum area with many varieties of trees and shrubs brought from all over the world (11).

Cochituate State Park—in Framingham, Natick, and Wayland towns; Cochituate Lake is surrounded by hardwood trees and tall evergreens (28).

Hopkinton State Park—in Ashland and Hopkinton towns; fishing and boating on reservoir (26).

John C. Robinson State Park—north of Feeding Hills; along shores of Westfield River; scenic views of level valleys from high wooded ridges; swimming pool (32).

Joseph Allen Skinner State Park—north of South Hadley; 70-mile panoramic view of broad Connecticut Valley and Mount Tom Range from Mount Holyoke; the Devil's Football, huge 300-ton magnetic boulder; Pass of Thermopylae, narrow mountain pass; Titan's Piazza, overhanging columns of volcanic rocks (23).

Lindon Bates Memorial State Park—west of Pittsfield; forest park on Lebanon Mt.; wildlife sanctuary; views from foot trails of Lebanon Valley (15).

Roland C. Nickerson State Forest Park—in heart of Cape Cod section; large clear-water ponds with white sandy beaches in wooded hills; largest ponds are Cliff, Little Cliff, Flax, and Higgins (43).

Salisbury Beach State Reservation—ocean beach on Atlantic coast between New Hampshire boundary and Merrimack River; sea fishing off Black Rocks; Indian shell mounds; salt marshes (10).

Standish Monument State Reservation—at South Duxbury; on 130-foot observation tower is statue of Miles Standish; Pilgrim leader lived on site 1632–56 (39).

Wahconah Falls State Park—near Dalton; brook and falls in beautiful setting; picnicking and fishing (14).

Whitehall State Park—in Hopkinton; large reservoir with steep, rugged shores covered with hardwood and evergreen trees (27).

*Numbers in parentheses are keyed to map.

STATE FORESTS*†

Bash-Bish Falls (Mount Washington town)—390 acres; Bash-Bish Brook cascades down 60-foot drop (30).

Beartown (Monterey, Great Barrington, Lee, Tyringham towns)—8,004 acres; winter sports area (31).

Douglas (Douglas town)—3,461 acres; sandy beach on shores of Wallum Lake; picnic area (37).

East Mountain (Great Barrington town)—1,553 acres; facilities for skiing (31).

Erving (Erving, Northfield, Orange, Warwick towns)—5,417 acres; Laurel Lake, fishing; picnicking (3).

Harold Parker (Andover, North Andover, Middleton, North Reading towns)—2,903 acres; ten ponds; fishing and other sports facilities; picnicking, camping (9).

Mohawk Trail (Charlemont, Hawley, Savoy, Florida towns)—6,246 acres; famous trail named for marauding Canadian Mohawk Indians; brooks and rivers (2).

Mount Grace (Warwick town)—1,224 acres; winter sports on Mount Grace (1,625 feet); picnic area (4).

Myles Standish (Plymouth, Carver towns)—10,910 acres; one of oldest recreational areas in state (41).

Otter River (Winchendon, Templeton, Royalston towns)—832 acres; recreation centers at Beaman Pond; picnicking and camping (5).

Pittsfield (Pittsfield, Hancock, Lanesboro towns)—5,011 acres; Burgoyne Trail, road used by defeated British army after battle of Saratoga; Radium Springs Cave, a 450-ft. length of water-carved marble; picnicking (13).

Spencer (Spencer town)—1,016 acres; fishing and hunting in area once home of inventor Elias Howe (35).

Willard Brook (Ashby, Townsend, Lunenburg towns)—1,736 acres; waterfalls and rapids through wooded valley; 20-ft. Trap Falls; dam forms swimming pool (6).

†There are 28 state forests; 13 are given here.

Massachusetts Fact Summary

LARGEST CITIES (1950 census)

Boston (801,444): state capital; important Atlantic seaport; largest industries include food products, clothing, and electrical machinery; huge fisheries.
Worcester (203,486): centrally located industrial city; makes abrasives, wire, looms, hardware, and clocks.
Springfield (162,399): manufacturing city producing electrical and automotive equipment, firearms, tires.
Cambridge (120,740): historic, cultural suburb of Boston; seat of Harvard University, M.I.T., Radcliffe College.
Fall River (111,963): important textile center; cotton, rayon, and silk goods; men's and women's clothing.
New Bedford (109,189): textile center on Buzzards Bay; electrical appliances; rubber, copper, brass products.
Somerville (102,351): residential suburb of Boston.
Lynn (99,738): Atlantic port and shoe manufacturing center; also makes electrical apparatus and clothing.
Lowell (97,249): textile center; hydroelectric power.
Quincy (83,835): suburb of Boston; Atlantic harbor; shipbuilding; makes machinery, motors, rubber products.
Newton (81,994): residential suburb of Boston; electronics.
Lawrence (80,536): center of worsted cloth manufacturing; shoes, cotton textiles, woolen goods, men's clothing.
Medford (66,113): suburb northwest of Boston.
Brockton (62,860): men's shoes, Wm. Cullen Bryant home.
Malden (59,804): residential suburb north of Boston.

EDUCATION

Public Schools: Elementary, 1,705; secondary, 333; consolidated, 88. Compulsory school age, 7 to 16. State Board of Education composed of 9 members appointed by governor for 9-year terms. State commissioner of education appointed by the state board for 5-year term. Union or district supts. appointed by joint school committees of towns in union or district concerned. Town or city school committees, of 3 to 9 members elected for 3-year terms, appoint city and town superintendents.
Private and Parochial Schools: 695.
Colleges and Universities (accredited): Colleges, 62; junior colleges, 33. State-supported schools include University of Massachusetts, Amherst; 10 teachers colleges—Boston, Bridgewater, Fitchburg, Framingham, Lowell, North Adams, Salem, Westfield, Worcester, and Mass. School of Art, Boston; Mass. Maritime Academy, Boston; Bradford Durfee Technical Institute, Fall River; Lowell Technological Institute of Mass.; New Bedford Institute of Textiles and Technology.
Special State Schools: Perkins Institution and Mass. School for the Blind, Watertown; Mass. Hospital School (for the crippled), Canton. State provides tuition at following private schools: for the blind—Perkins Institution, Watertown; for the deaf—American School, W. Hartford, Conn.; Beverly School, Beverly; Boston School, Randolph; Clarke School, Northampton; Horace Mann, Boston. Schools for feeble-minded—Wrentham, Belchertown, and Walter E. Fernald, Waverley. Industrial School for Boys, Shirley; Industrial School for Girls, Lancaster; Lyman School for Boys, Westboro.
Libraries: City and town public libraries, 395; 3 regional libraries, operated with state funds, serve 6 counties. Division of Library Extension, Dept. of Education, headed by director, responsible for aid in developing library service. Noted special libraries: Boston Athenaeum, Boston Medical, Grand Lodge of Masons, Massachusetts Historical Society, Massachusetts Horticultural Society, New England Historic Genealogical Society, all in Boston; Essex Institute, Salem; American Antiquarian Society, Worcester.
Outstanding Museums: Museum of Fine Arts and Gardner Museum, both in Boston; the Agassiz, Fogg, Germanic, and Peabody Museums at Harvard University, Cambridge; Museum of Fine Arts, Springfield; Worcester Art Museum, Worcester.

CORRECTIONAL AND PENAL INSTITUTIONS

State Farm, South Bridgewater; Mass. Reformatory, West Concord; Reformatory for Women, Framingham; Mass. State Prison Colony, Norfolk; Mass. State Prison, Charlestown; Mass. Prison Camp, South Carver.

THE PEOPLE BUILD THEIR STATE

1000—Leif Ericson may have touched on coast of Massachusetts.
1524—Giovanni da Verrazano cruises along New England coast.
1525—Estavan Gómez, a Portuguese in the service of Spain, sails along Massachusetts coast.
1578—Sir Humphrey Gilbert gets colonization patent for Massachusetts area.
1602—Bartholomew Gosnold (English) explores Massachusetts coast, gives Cape Cod its name.
1603—Martin Pring explores coast of Massachusetts.
1604—Samuel de Champlain explores and maps coast.
1606—King James grants charter to Plymouth Company to colonize "Northern Virginia" (38° to 45° N.).
1614—Capt. John Smith maps coast. Adriaen Block (Dutch) explores Cape Cod.
1619—Religious Separatists (the Pilgrims) get right to settle in Virginia.
1620—Plymouth Company reorganized as Council for New England. Pilgrims land at Plymouth Rock in *Mayflower*; draw up "Mayflower compact"; found Plymouth; elect John Carver governor.
1621—William Bradford elected governor of Plymouth Colony; new colonists begin to arrive; settlers celebrate the first Thanksgiving Day.
1628—Charles I of England grants colonial charter to Massachusetts. John Endicott founds settlement of Puritans at what is now Salem.
1629—Massachusetts Bay Company chartered; voting franchise includes only church members.
1630—Puritan "great migration" from England to America begins; eventually about 14,000 settle in Massachusetts area; Dorchester founded; John Winthrop and group of colonists establish Boston.
1631—*Blessing of the Bay* is first ship built in Massachusetts; start of great shipbuilding industry.
1632—Boston made capital of Massachusetts Bay Colony.
1636—Harvard University is founded; is oldest institution of higher learning in U.S.
1638—First Massachusetts shoe factory opened at Lynn.
1639—Stephen Daye sets up in Cambridge first printing press in English-speaking North America; prints first book, 'Bay Psalm Book', 1640.
1643—First woolen mill in colonies opened at Rowley. Puritan colonies form New England Confederation to oppose Dutch and Indian attacks. First producing iron works in New World built at Saugus; considered birthplace of U. S. steel industry.

Massachusetts Fact Summary

1647—Law passed requiring establishment of elementary schools in towns of 50 families or more and of secondary schools in towns of 100 families; first school law of its kind in North America.

1657—"Halfway Covenant" eases restrictions on church membership and hence on voting franchise; this lessened church control of government.

1675—King Philip's War brings Indian attacks on settlers.

1684—Massachusetts charter annulled.

1686—Dominion of New England (Massachusetts, Plymouth, Rhode Island, Connecticut, New Hampshire, Maine, and other colonies) established.

1690—*Publick Occurrences*, published in Boston, is first newspaper in English-speaking America.

1691—William and Mary grant new charter to Massachusetts; becomes a royal colony with governor appointed by king; church membership as condition for voting abolished. Colony includes Maine and Plymouth. Witchcraft trials begin in Salem.

1744—King George's War starts; Massachusetts soldiers, aided by British warships, capture French fort at Louisbourg on Cape Breton Island, 1745.

1763—Pontiac leads Indian attacks on west Massachusetts settlers.

1764—Sugar Act passed, giving British merchants monopoly of American sugar market.

1765—Stamp Act imposed by Britain; Massachusetts House of Representatives issues call to all colonies for Stamp Act Congress; Congress, meeting in New York, asks for repeal of act; act repealed, 1766.

1767—First regular stagecoach line begins operation from Boston to Providence, R. I. Townshend Acts (higher taxes) increase colonial discontent.

1770—Resentful Boston colonists taunt British troops and are fired upon in "Boston Massacre," March 5. Townshend Acts repealed.

1773—Tea Act gives tea monopoly to East India Company; "Boston Tea Party," dumps cargoes of tea into the bay.

1774—Massachusetts colonists in meeting at Faneuil Hall in Boston vote to oppose taxation measures.

1775—Paul Revere on April 18 makes his famous ride to warn of approach of British troops. Battles of Lexington and Concord, April 19, and of Bunker Hill, June 17, mark start of Revolutionary War; Boston, held by British, is besieged by revolutionaries.

1776—Colonial troops, led by Gen. George Washington, force British to evacuate Boston, March 17.

1778—Convention drafts state constitution drawn up by John Adams; constitution adopted, June 7, 1780; is oldest constitution still in effect in United States.

1780—John Hancock becomes first elected governor.

1785—Return of New York ship *Empress of China* from China marks beginning of U.S.-China trade; Massachusetts surrenders western lands to U. S.

1786—Daniel Shays' rebellion in western Massachusetts quelled.

1788—Massachusetts is sixth state to ratify U. S. Constitution, February 6.

1789—The *Franklin* of Boston is first U. S. ship to enter a Japanese port.

1796—John Adams, born 1735 in Quincy, elected 2d president of the U. S.

1807—U. S. Embargo Act prohibits shipments to foreign ports; Massachusetts shipping suffers; embargo forces development of native manufactures.

1812—War with Great Britain brings further restriction of Massachusetts shipping.

1814—Massachusetts legislature calls Hartford Convention of representatives of New England states to discuss states' rights and trade restrictions.

1820—Maine separated from Massachusetts.

1822—Lowell set up as model factory town based on plans of Francis C. Lowell. Boston chartered as a city.

1824—John Quincy Adams, born 1767 in Quincy, elected 6th president of the U. S.

1825—Opening of Erie Canal brings products of West to the East; Massachusetts' agriculture declines.

1826—First railroad in U. S. with iron rails opened between Quincy and Milton; cars drawn by horses.

1829—Perkins Institution for the Blind founded in Boston by Samuel Gridley Howe; opened, 1832; is one of first three schools of its kind in U. S.

1831—William Lloyd Garrison establishes The *Liberator* in Boston as spearhead of antislavery movement.

1832—Antislavery Society formed in Boston.

1833—Constitutional amendment separates church and state; ends Puritanism in government.

1837—State Board of Education established under leadership of Horace Mann; begins series of revolutionary educational reforms.

1839—First teachers college in U. S. opened at Lexington.

1840—The *Dial*, published by Margaret Fuller in Boston, expresses the ideas of the Transcendentalists.

1845—Invention of sewing machine by Elias Howe booms textile and shoe industries.

1846—Anesthesia first successfully demonstrated at Massachusetts General Hospital, Boston.

1849—State Board of Health established.

1852—Boston Public Library opened; is one of the first tax-supported city libraries in U. S.: opens first branch library in U. S., 1871.

1857—The *Atlantic Monthly* founded in Boston, James Russell Lowell is first editor; many famous Massachusetts writers contribute to it.

1861—Massachusetts soldiers are first Union troops to die in Civil War when Baltimore mob attacks Sixth Massachusetts Regiment. Massachusetts Institute of Technology chartered; opened, 1865.

1867—Mary Baker Eddy founds Christian Science religion at Lynn.

1869—Last of the whaling ships fitted out in New Bedford.

1875—Hoosac Tunnel opened through Hoosac Mt.

1881—Clara Barton, born near Oxford, becomes first president of American Red Cross.

1894—The First Church of Christ, Scientist, completed in Boston.

1897—Boston completes first subway in U. S.

1908—Ford Hall Forum established in Boston.

1914—Canal connects Cape Cod Bay with Buzzards Bay.

1918—German submarine shells shipping off Cape Cod.

1919—Boston police strike; Gov. Calvin Coolidge wins prominence in ending strike; elected vice-president, 1920, and 30th president of U.S., 1923.

1920—Nicola Sacco and Bartolomeo Vanzetti, alleged anarchists, arrested on charge of murder and robbery in South Braintree; executed 1927; political aspects of case gain world-wide attention.

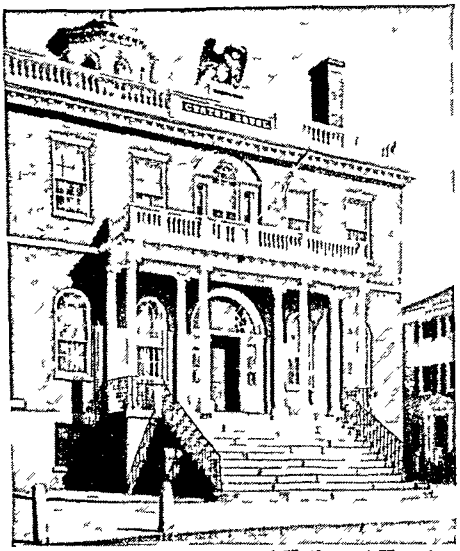
1930—Massachusetts Bay Colony Tercentenary celebrated in Boston.

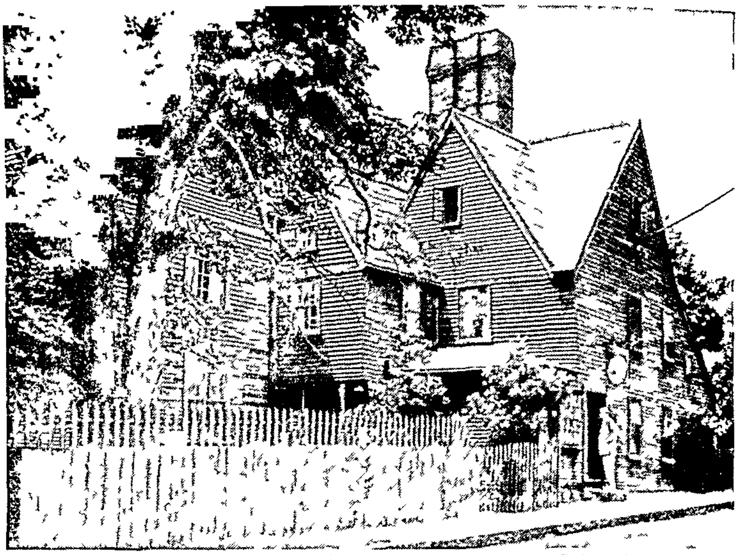
1948—Youth Service Board established.

1949—Loyalty oath required of public officials.

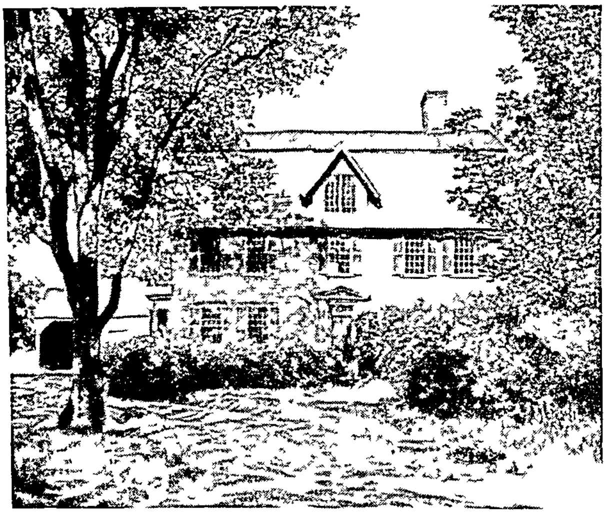
1951—Northern Circumferential Highway by-passing Boston dedicated.

1953—Unprecedented tornado in Worcester County causes loss of 97 lives and $55,000,000 in property.





Salem is rich in memories of Nathaniel Hawthorne. He was born there, and he worked several years in the Salem Custom House (left) as surveyor of the port. The House of the Seven Gables (right) is said to be the setting for his novel of that name.



Concord also has literary importance. Ralph Waldo Emerson and Hawthorne lived in the Old Manse (left), and Hawthorne wrote about it in his 'Mosses from an Old Manse'. Louisa May Alcott wrote 'Little Women' in the Alcott home, Orchard House (right).

In Sleepy Hollow Cemetery (left) at Concord, lie many notable authors—Emerson, Hawthorne, the Alcotts, Henry D. Thoreau, and others. John Greenleaf Whittier was born near Haverhill in this farmhouse (right). He described it in his poem 'Snowbound'.

MASSACHUSETTS

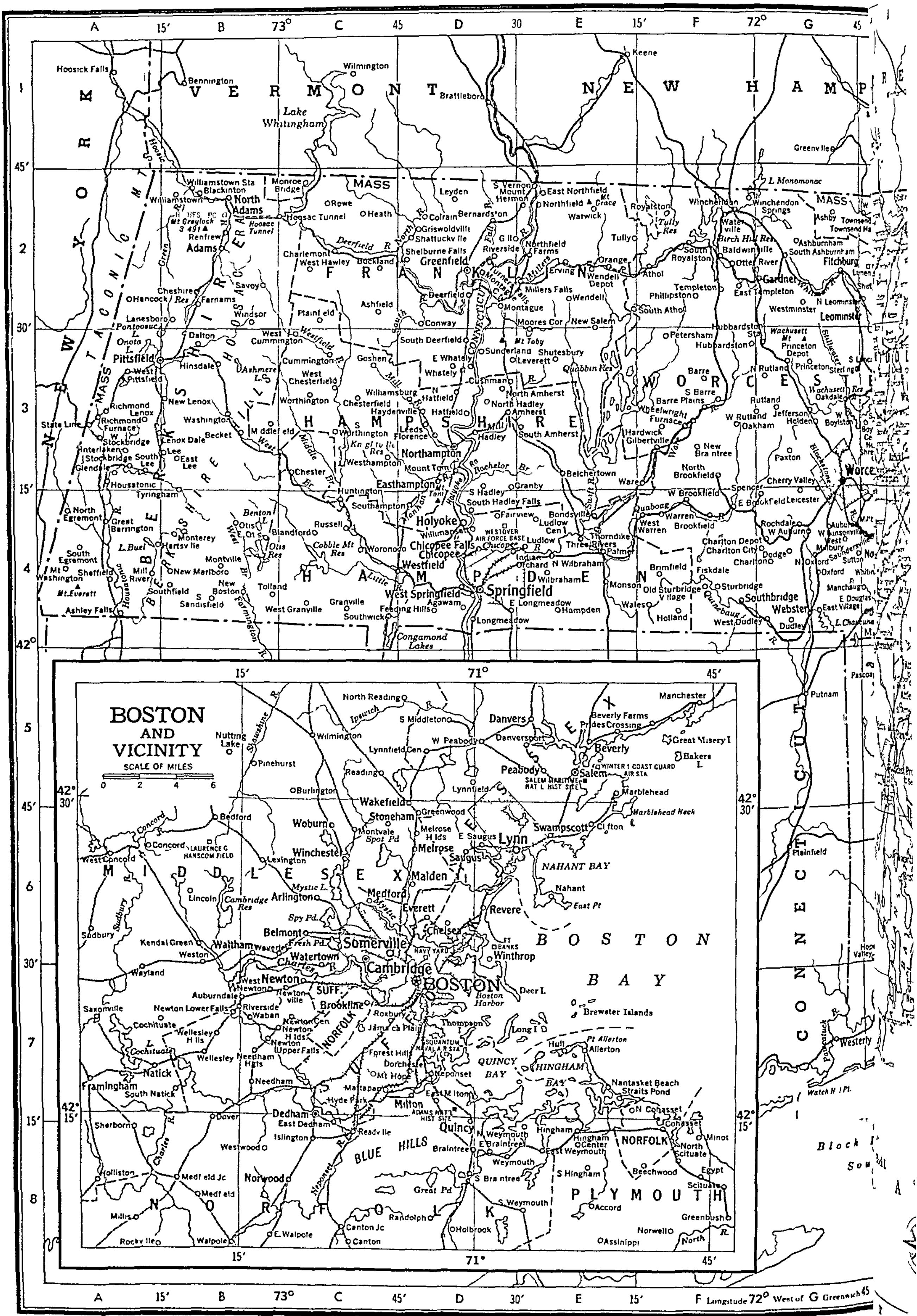
COUNTIES

Barnstable	46,805	N 6
Berkshire	132,966	B 3
Bristol	381,569	K 5
Dukes	5,633	M 7
Essex	522,384	L 2
Franklin	52,747	D 2
Hampden	367,971	D 4
Hampshire	87,594	D 3
Middlesex	1,064,569	J 3
Nantucket	3,484	O 7
Norfolk	392,308	K 4
Plymouth	189,468	L 5
Suffolk	896,615	K 3
Worcester	546,401	G 3

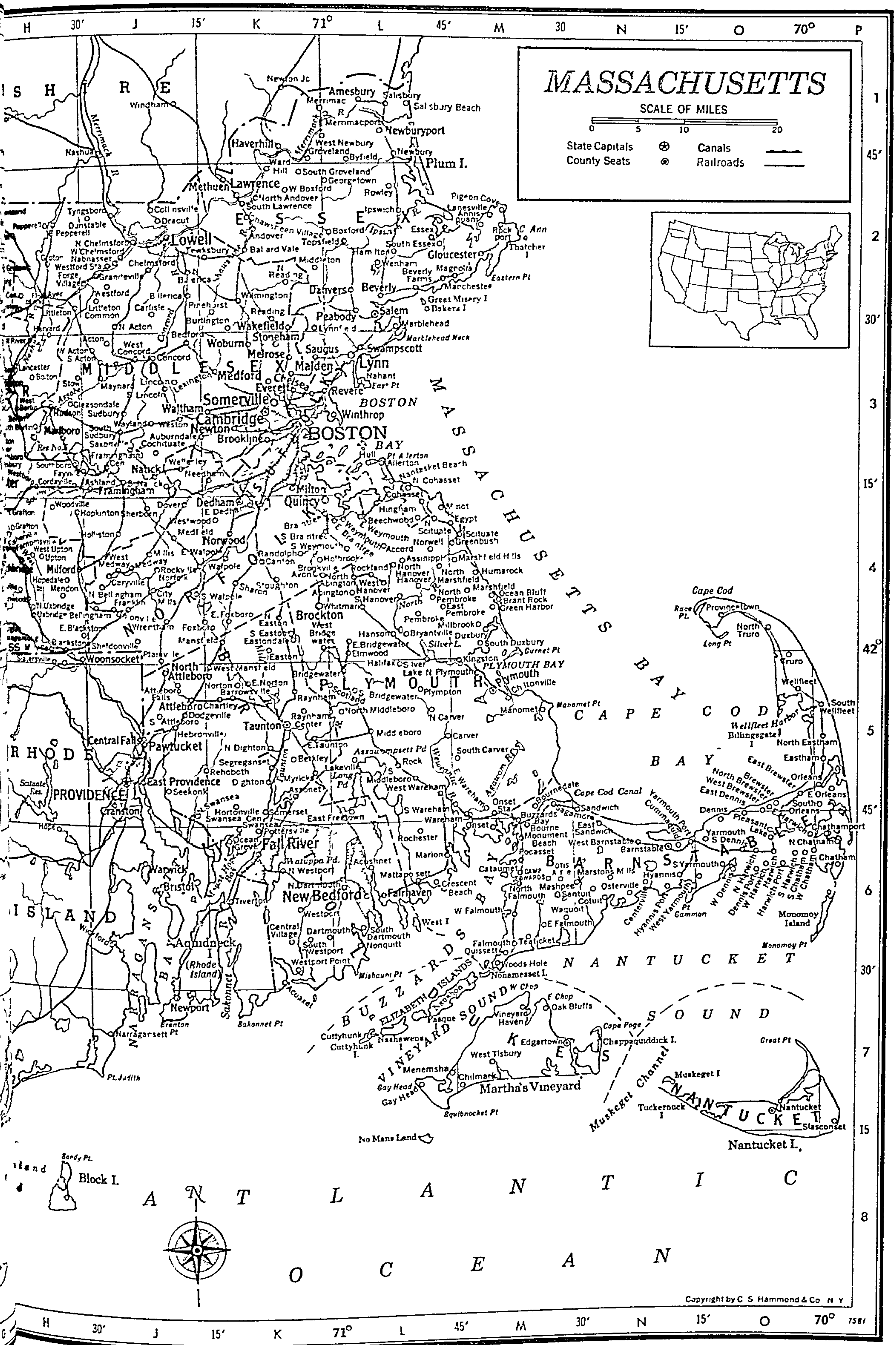
CITIES AND TOWNS

Abington	†7,152	L 4
Accord	150	E 8
Acoaxet	130	K 7
Acton	†3,510	J 3
Acushnet	†4,401	L 6
Adams	†12,034	B 2
Agawam	†10,166	D 4
Allerton	500	E 7
Amesbury	†10,851	L 1
Amherst	†10,856	E 3
Andover	†12,437	K 2
Annisquam		M 2
Arlington	†44,353	C 6
Ashburnham	†2,603	G 2
Ashby	†1,464	G 2
Ashfield	†977	C 2
Ashland	†3,500	J 3
Ashley Falls	500	A 4
Assinippi	500	E 8
Assonet	1,002	K 5
Athol	†11,554	F 2
Attleboro	23,809	J 5
Attleboro Falls	2,500	J 5
Auburn	†8,840	G 4
Auburndale	6,218	B 7
Avon	†2,666	K 4
Ayer	†5,740	H 2
Baldwinville	1,407	F 2
Ballard Vale	1,200	K 2
Barnstable	†10,480	N 6
Barre	†3,406	F 3
Barre Plains	144	F 3
Barrowsville	700	K 5
Becket	†755	B 3
Bedford	†5,234	B 6
Beechwood	200	F 8
Belchertown	†4,487	E 3
Bellingham	†4,100	J 4
Belmont	†27,381	C 6
Berkley	†1,284	K 5
Berlin	†1,349	H 3
Bernardston	†1,117	D 2
Beverly	28,884	E 5
Beverly Farms	2,500	E 5
Billerica	†11,101	J 2
Blackinton	440	B 2
Blackstone	†4,968	H 4
Blandford	†597	C 4
Bolton	†956	H 3
Bondsville	1,200	E 4
BOSTON	801,444	D 7
Bourne	†4,720	M 6
Bournedale		M 5
Boxford	†926	K 2
Boylston Center		H 3
Braintree	†23,161	D 8
Brant Rock	350	M 4
Brewster	†987	O 5
Bridgewater	†9,512	K 5
Brimfield	†1,182	F 4
Brockton	62,860	K 4
Brookfield	†1,567	F 4
Brookline	†57,589	C 7
Brookville	1,300	K 4
Bryantville		L 4
Buckland	†1,605	C 2
Burlington	†3,250	C 5
Buzzards Bay	1,459	M 5
Byfield	950	L 1
Cambridge	120,740	C 6
Canton	†7,465	C 8
Canton Junction		C 8
Carlisle	†846	J 2
Carver	†1,530	M 5
Caryville	300	J 4
Cataumet	100	M 6
Centerville	1,100	N 6
Central Village	350	K 6
Charlemont	†855	C 2
Charlton	†3,136	F 4
Charlton City	1,200	F 4
Charlton Depot	150	F 4
Chartley	600	K 5
Chatham	†2,457	P 6
Chathamport	150	P 6
Chelmsford	†9,407	J 2
Chelsea	38,912	D 6
Cherry Valley	1,300	G 3
Cheshire	†2,022	B 2
Chester	†1,292	C 3
Chesterfield	†496	C 3
Chicopee	49,211	D 4
Chicopee Falls	12,915	D 4
Chilmark	†183	M 7
Chiltonville		M 5
City Mills	500	J 4
Clifton	5,000	E 6
Clinton	†12,287	H 3
Cochituate	2,500	A 7
Cohasset	†3,731	F 7
Collinsville	1,500	J 2
Colrain	†1,546	D 2
Concord	†8,623	A 6
Conway	†873	D 2
Cordaville	250	H 3
Cotuit	700	N 6
Crescent Beach		M 6
Cummaquid	200	N 6
Cummington	†620	C 3
Cushman	250	D 3
Cuttyhunk	40	L 7
Dalton	†4,772	B 3
Danvers	†15,720	D 5
Danversport	2,500	E 5
Dartmouth	†11,115	K 6
Dedham	†18,487	C 7
Deerfield	†3,086	D 2
Dennis	†2,499	O 5
Dennis Port	1,080	O 6
Dighton	†2,950	K 5
Dodge	835	G 4
Dodgeville	1,500	K 5
Dorchester	*150,000*	D 7
Douglas	†2,624	H 4
Dover	†1,722	B 7
Dracut	†8,666	J 2
Dudley	†5,261	G 4
Dunstable	†522	J 2
Duxbury	†3,167	M 4
East Blackstone		H 4
E. Braintree	7,000	D 8
E. Brewster	500	O 5
E. Bridgewater	†4,412	L 4
E. Brookfield	†1,243	G 4
E. Dedham	5,000	C 8
E. Dennis	275	O 5
E. Douglas	1,846	G 4
E. Falmouth	1,405	M 6
E. Foxboro	500	K 4
E. Freetown	1,200	L 5
E. Harwich	500	O 6
E. Lee	350	B 3
E. Longmeadow	†4,881	E 4
E. Milton	7,500	D 7
E. Northfield	950	E 2
E. Norton	800	K 5
E. Orleans	383	P 5
E. Otis	95	B 4
E. Pembroke	200	M 4
E. Pepperell	2,500	H 2
E. Sandwich	325	N 6
E. Saugus		D 6
E. Taunton	5,000	K 5
E. Templeton	1,200	G 2
E. Village		G 4
E. Walpole	2,000	C 8
E. Wareham	500	M 5
E. Weymouth	10,000	E 8
E. Whately		D 3
Eastham	†860	O 5
Easthampton	†10,694	D 3
Easton	†6,244	K 4
Eastondale	600	K 4
Edgartown	†1,508	M 7
Egypt	600	F 8
Elmwood	350	L 4
Erving	†1,322	E 2
Essex	†1,794	L 2
Everett	45,982	D 6
Fairhaven	†12,764	L 6
Fairview	2,108	D 4
Fall River	111,963	K 6
Falmouth	†8,662	M 6
Farnams	200	B 2
Farnumsville	1,427	H 4
Fayville	1,000	H 3
Feeding Hills	3,500	D 4
Fisherville	1,167	H 4
Fiskdale		F 4
Fitchburg	42,691	G 2
Florence	4,500	D 3
Forest Hills	10,000	C 7
Forge Village	1,115	H 2
Foxboro	†7,030	J 4
Framingham	†28,086	A 7
Framingham Center	4,500	J 3
Franklin	†8,037	J 4
Furnace	150	F 3
Gardner	19,581	G 2
Gay Head	†88	L 7
Georgetown	†2,411	L 2
Gilbertville	1,039	F 3
Gill	†1,070	D 2
Gleasondale		J 3
Glendale	350	A 3
Gloucester	25,167	M 2
Goshen	†321	C 3
Grafton	†8,281	H 4
Granby	†1,861	E 3
Graniteville	1,000	J 2
Granville	†740	C 4
Great Barrington	†6,712	A 4
Green Harbor	300	M 4
Greenbush	650	F 8
Greenfield	†17,349	D 2
Greenwood	5,500	D 6
Griswoldville	590	D 2
Groton	†2,889	H 2
Groveland	†2,340	L 1
Hadley	†2,639	D 3
Halifax	†944	L 5
Hamilton	†2,764	L 2
Hampden	†1,322	E 4
Hancock	†445	A 2
Hanover	†3,389	L 4
Hanson	†3,264	L 4
Hardwick	†2,348	F 3
Hartsville		B 4
Harvard	†3,983	H 2
Harwich	†2,649	O 6
Harwich Port	1,350	O 6
Hatfield	†2,179	D 3
Haverhill	47,280	K 1
Haydenville	1,009	C 3
Heath	†305	C 2
Hebronville	754	J 5
Hingham	†10,665	E 8
Hingham Center		E 8
Hinsdale	†1,560	B 3
Holbrook	†4,004	D 8
Holden	†5,975	G 3
Holland	†377	F 4
Holliston	†3,753	A 8
Holyoke	54,661	D 4
Hoosac Tunnel	150	C 2
Hopedale	†3,479	H 4
Hopkinton	†3,486	J 4
Hortonville		K 5
Housatonic	1,601	A 3
Hubbardston	†1,134	F 3
Hubbardston Station	120	F 3
Hudson	†8,211	H 3
Hull	†3,379	E 7
Humarock	50	M 4
Huntington	†1,257	C 4
Hyannis	4,235	N 6
Hyannis Port	300	N 6
Hyde Park		C 7
Indian Orchard	10,000	E 4
Interlaken	60	A 3
Ipswich	†6,895	L 2
Islington	2,300	C 8
Jamaica Plain		C 7
Jefferson		G 3
Kendal Green		B 6
Kingston	†3,461	M 5
Lakeville	†2,066	L 5
Lancaster	†3,601	H 3
Lanesboro	†2,069	A 2
Lanesville	1,046	M 2
Lawrence	80,536	K 2
Lee	†4,820	B 3
Leeds	1,700	D 3
Leicester	†6,029	G 4
Lenox	†3,627	A 3
Lenox Dale	500	B 3
Leominster	24,075	G 2
Leverett	†791	E 3
Lexington	†17,335	B 6
Leyden	†306	D 2
Lincoln	†2,427	B 6
Linwood	981	H 4
Littleton	†2,349	H 2
Littleton Common	1,017	J 2
Longmeadow	†6,508	D 4
Lowell	97,249	J 2
Ludlow	†8,660	E 4
Ludlow Ctr.	500	E 4
Lunenburg	†3,906	H 2
Lynn	99,738	D 6
Lynnfield	†3,927	D 5
Lynnfield Ctr.	2,600	C 5
Magnolia		M 2
Malden	59,804	D 6
Manchaug	790	G 4
Manchester	†2,868	F 5
Manomet	350	M 5
Mansfield	†7,184	J 4
Marblehead	†13,765	E 5
Marion	†2,250	L 6
Marlboro	15,756	H 3
Marshfield	†3,267	M 4
Marshfield Hills	500	M 4
Marstons Mills	600	N 6
Mashpee	†438	M 6
Mattapan		C 7
Mattapoisett	†2,265	L 6
Maynard	†6,978	J 3
Medfield	†4,549	B 8
Medfield Jct.	500	B 8
Medford	66,113	C 6
Medway	†3,744	J 4
Melrose	26,988	D 6
Melrose Highlands	7,713	D 6
Mendon	†1,619	H 4
Menemsha	65	L 7
Merrimac	†2,804	L 1
Merrimacport	210	L 1
Methuen	†24,477	K 2
Middleboro	†10,164	L 5
Middlefield	†295	B 3
Middleton	†2,916	K 2
Milford	†15,442	H 4
Mill River	300	A 4
Millbrook	200	M 4
Millbury	†8,347	H 4
Millers Falls	1,134	E 2
Millis	†2,551	A 8
Millville	†1,692	H 4
Milton	†22,395	D 7
Minot	150	F 8
Monroe Bridge	150	C 2
Monson	†6,125	E 4
Montague	†7,812	E 2
Montague City	668	D 2
Monterey	†367	B 4
Montvale		C 6
Montville		B 4
Monument Beach	650	M 6
Moores Corner		E 2
Mt. Hermon	750	D 2
Mt. Hope	5,000	C 7
Mt. Tom	230	D 3
Mt. Washington	†34	A 4

†Population of Town [Township.]



BOSTON
AND
VICINITY
SCALE OF MILES
0 2 4 6
V E R M O N T
N E W H A M P
N E W Y O R K
MASS
F R A N K L I N
B E R K S H I R E
H A M P S H I R E
H A M P D E N
W O R C E S T E R
C O N N E C T I C U T
M I D D L E S E X
E S S E X
S U F F O L K
N O R F O L K
P L Y M O U T H
B O S T O N
B A Y
NAHANT BAY
QUINCY BAY
HINGHAM BAY
BLUE HILLS
Boston Harbor
Brewster Islands
Hoosick Falls
Bennington
Wilmington
Brattleboro
Keene
Lake Whitingham
Greenville
Williamstown Sta
Blackinton
Williamstown
North Adams
Adams
Hoosac Tunnel
Mt Greylock 3 491
Monroe Bridge
Rowe
Heath
Leyden
Colrain
Bernardston
East Northfield
Northfield
Warwick
Royalston
Winchendon
Winchendon Springs
Ashby
Townsend
Greenfield
Shelburne Falls
Charlemont
West Hawley
Buckland
Deerfield
Montague
Turners Falls
Millers Falls
Erving
Wendell
Wendell Depot
Orange
Athol
South Royalston
Baldwinville
Otter River
Gardner
Fitchburg
Templeton
East Templeton
Phillipston
South Athol
Westminster
Leominster
Cheshire
Farnams
Savoy
Hancock
Lanesboro
Windsor
Plainfield
Ashfield
Conway
Moores Cor
New Salem
Petersham
Hubbardston
Princeton
Dalton
Pittsfield
West Pittsfield
Hinsdale
West Cummington
Cummington
Goshen
South Deerfield
Sunderland
Shutesbury
Leverett
Whately
East Whately
Cushman
North Amherst
North Hadley
Amherst
South Amherst
Hadley
Barre
Barre Plains
Rutland
Wheelwright
Hardwick
Gilbertville
Oakham
Paxton
Holden
Jefferson
Richmond
Lenox
New Lenox
Washington
Becket
Middlefield
Worthington
Chesterfield
Williamsburg
Haydenville
Leeds
Florence
Hatfield
Northampton
Mount Tom
Westhampton
State Line
Stockbridge
West Stockbridge
Lenox Dale
Lee
South Lee
East Lee
Interlaken
Glendale
Housatonic
Tyringham
Chester
Huntington
Easthampton
Southampton
Granby
South Hadley
South Hadley Falls
Belchertown
Ware
North Brookfield
West Brookfield
Spencer
Cherry Valley
Leicester
Worcester
North Egremont
Great Barrington
Monterey
Otis
Blandford
Russell
Holyoke
Willimansett
Chicopee Falls
Chicopee
Fairview
Ludlow
Bondsville
Thorndike
Three Rivers
Palmer
Warren
West Warren
Brookfield
East Brookfield
Rochdale
Auburn
South Egremont
Sheffield
Mill River
New Marlboro
Montville
New Boston
Southfield
Sandisfield
Tolland
Granville
Westfield
West Springfield
Springfield
Agawam
Feeding Hills
Southwick
Longmeadow
East Longmeadow
Hampden
Wilbraham
North Wilbraham
Indian Orchard
Monson
Wales
Brimfield
Holland
Fiskdale
Sturbridge
Southbridge
Charlton
Charlton Depot
Charlton City
Dodge
Oxford
North Oxford
Webster
Dudley
West Dudley
Ashley Falls
Mt Everett
Mt Washington
Congamond Lakes
Putnam
Plainfield
Westerly
Block I
North Reading
Manchester
Beverly Farms
Prides Crossing
S Middleton
Danvers
Danversport
Beverly
Great Misery I
Bakers I
Nutting Lake
Wilmington
Pinehurst
Lynnfield Cen
W Peabody
Peabody
Salem
Reading
Burlington
Wakefield
Lynnfield
Marblehead
Marblehead Neck
Bedford
Concord
West Concord
Lexington
Woburn
Stoneham
Greenwood
Melrose
Melrose Hlds
Winchester
Montvale
Spot Pd
E Saugus
Saugus
Lynn
Swampscott
Clifton
Malden
Lincoln
Cambridge Res
Arlington
Mystic L
Medford
Nahant
East Pt
Everett
Chelsea
Revere
Sudbury
Belmont
Spy Pd
Fresh Pd
Somerville
Kendal Green
Waltham
Waverley
Weston
Watertown
Winthrop
Wayland
Cambridge
BOSTON
Newton
West Newton
Auburndale
Newtonville
Deer I
Saxonville
Newton Lower Falls
Riverside
Waban
Brookline
Roxbury
Jamaica Plain
Cochituate
Wellesley Hills
Wellesley
Newton Cen
Newton Hlds
Newton Upper Falls
Needham Hgts
Thompson I
Long I
Hull
Pt Allerton
Allerton
Forest Hill
Dorchester
Natick
South Natick
Needham
Mt Hope
Neponset
Nantasket Beach
Framingham
Mattapan
Hyde Park
East Milton
Milton
Quincy
N Cohasset
Cohasset
Dedham
East Dedham
Dover
Sherborn
Readville
Islington
Westwood
Weymouth
E Braintree
Braintree
Hingham
Hingham Center
East Weymouth
North Scituate
Minot
Holliston
Medfield Jc
Medfield
Norwood
S Braintree
Great Pd
S Hingham
Beechwood
Egypt
Scituate
S Weymouth
Accord
Millis
Randolph
Holbrook
Greenbush
Rockville
Walpole
E Walpole
Canton Jc
Canton
Norwell
Assinippi
Longitude 72° West of Greenwich


MASSACHUSETTS
SCALE OF MILES
0 5 10 20
State Capitals
County Seats
Canals
Railroads
H 30′ J 15′ K 71° L 45′ M 30 N 15′ O 70° P
1 45′ 2 30′ 3 15′ 4 42° 5 45′ 6 30′ 7 15 8
ESSEX
MIDDLESEX
NORFOLK
PLYMOUTH
BARNSTABLE
DUKES
NANTUCKET
RHODE ISLAND
PROVIDENCE
BOSTON
BOSTON BAY
MASSACHUSETTS BAY
CAPE COD BAY
PLYMOUTH BAY
BUZZARDS BAY
NARRAGANSETT BAY
VINEYARD SOUND
NANTUCKET SOUND
ELIZABETH ISLANDS
Muskeget Channel
ATLANTIC OCEAN
Amesbury
Newburyport
Haverhill
Lawrence
Methuen
Lowell
Gloucester
Beverly
Salem
Peabody
Lynn
Woburn
Medford
Malden
Somerville
Cambridge
Newton
Brookline
Quincy
Dedham
Norwood
Framingham
Brockton
Taunton
Attleboro
Pawtucket
Central Falls
Woonsocket
Cranston
East Providence
Fall River
New Bedford
Newport
Plymouth
Cape Cod
Cape Cod Canal
Provincetown
Chatham
Hyannis
Barnstable
Martha's Vineyard
Edgartown
Nantucket
Nantucket I.
Block I.
No Mans Land
Plum I.
C Ann
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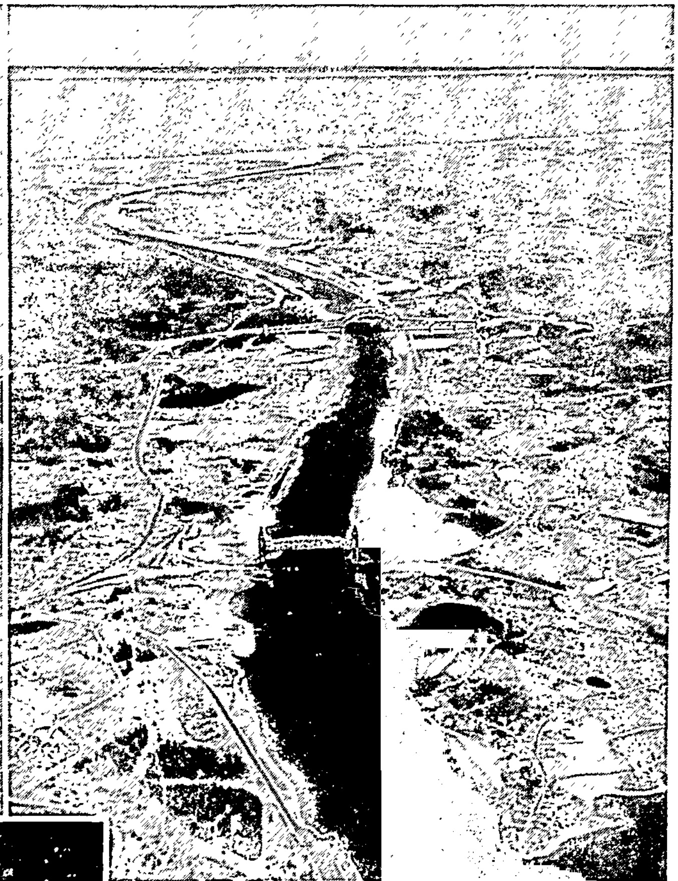
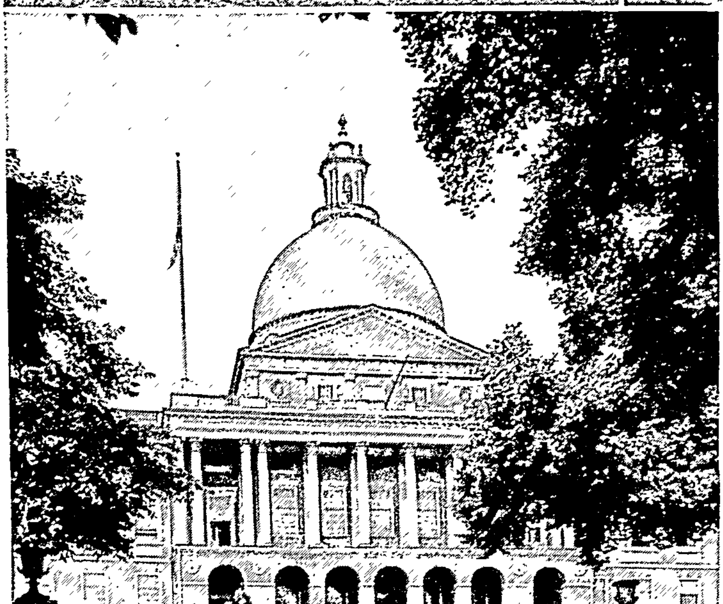
MASSACHUSETTS—*Continued*

Myricks	210	K 5
Nabnasset	500	J 2
Nahant	†2,679	E 6
Nantasket Beach	1,900	E 7
Nantucket	†3,484	O 7
Natick	†19,838	A 7
Needham	†16,313	B 7
Needham Heights	5,500	B 7
Neponset		D 7
New Bedford	109,189	K 6
New Boston		B 4
New Braintree	†478	F 3
New Lenox		B 3
New Marlboro	†989	B 4
New Salem	†392	E 2
Newbury	†1,994	L 1
Newburyport	14,111	L 1
Newton	81,994	C 7
Newton Center	15,214	C 7
Newton Highlands	11,480	C 7
Newton Lower Falls	1,215	B 7
Newton Upper Falls	3,451	C 7
Newtonville	13,689	C 7
Nonquitt	18	L 6
Norfolk	†2,704	J 4
N. Abington	3,906	L 4
N. Acton	300	J 2
N. Adams	21,567	B 2
N. Amherst	750	E 3
N. Andover	†8,485	K 2
N. Attleboro	†12,146	J 5
N. Bellingham	300	J 4
N. Billerica	3,300	J 2
N. Brewster		O 5
N. Brookfield	†3,444	F 3
N. Carver		L 5
N. Chatham	200	O 6
N. Chelmsford	3,249	J 2
N. Cohasset		F 7
N. Dartmouth		K 6
N. Dighton	1,000	K 5
N. Eastham	270	O 5
N. Easton	4,000	K 4
N. Egremont	215	A 4
N. Falmouth	800	M 6
N. Grafton	2,000	H 4
N. Hadley	1,000	D 3
N. Hanover	800	L 4
N. Harwich	210	O 6
N. Hatfield	300	D 3
N. Leominster		G 2
N. Marshfield	450	M 4
N. Middleboro	500	L 5
N. Oxford	1,250	G 4
N. Pembroke	400	M 4
N. Plymouth	4,000	L 5
N. Reading	†4,402	C 5
N. Rutland	125	G 3
N. Scituate	1,100	F 8
N. Swansea		K 5
N. Truro	250	O 4
N. Uxbridge	2,100	H 4
N. Westport	3,000	K 6
N. Weymouth	700	D 8
N. Wilbraham		E 4
Northampton	29,063	D 3
Northboro	†3,122	H 3
Northbridge	†10,476	H 4
Northfield	†2,246	E 2
Northfield Farms	500	E 2
Norton	4,401	K 5
Norwell	†2,515	F 8
Norwood	†16,636	B 8
Nutting Lake		B 5
Oak Bluffs	†1,521	M 7
Oakdale		G 3
Oakham	†455	F 3
Ocean Bluff	300	M 4
Ocean Grove	1,000	K 6
Old Sturbridge Village		F 4
Onset	1,674	M 6
Onset Station		M 5
Orange	†5,894	E 2
Orleans	†1,759	O 5
Osterville	1,003	N 6
Otis	†359	B 4
Otter River		F 2
Oxford	†5,841	G 4
Palmer	†9,533	E 4
Paxton	†1,066	G 3
Peabody	22,645	E 5
Pembroke	†2,579	L 4
Pepperell	†3,460	H 2
Petersham	†814	F 3
Phillipston	†638	F 2
Pigeon Cove	1,011	M 2
Pinehurst	2,905	K 2
Pittsfield	55,348	A 3
Plainfield	†228	C 2
Plainville	†2,088	J 4
Pleasant Lake	125	O 6
Plymouth	†13,608	M 5
Plympton	†697	L 5
Pocasset	500	M 6
Pottersville	2,700	K 6
Prides Crossing	450	E 5
Princeton	†1,032	G 3
Princeton Depot		G 3
Provincetown	†3,795	O 4
Quincy	83,835	D 7
Quissett	300	M 6
Randolph	†9,982	D 8
Raynham	†2,426	K 5
Raynham Ctr.	1,800	K 5
Reading	†14,006	C 5
Readville	6,000	C 8
Red Sta.		C 6
Rehoboth	†3,700	K 5
Renfrew		B 2
Revere	36,763	D 6
Richmond	†737	A 3
Richmond Furnace	250	A 3
Riverside		D 2
Riverside	400	B 7
Rochdale	1,800	G 4
Rochester	†1,328	L 6
Rock	600	L 5
Rockland	†8,960	L 4
Rockport	†4,231	M 2
Rockville	500	A 8
Rowe	†199	C 2
Rowley	†1,768	L 2
Roxbury		C 7
Royalston	†838	F 2
Russell	†1,298	C 4
Rutland	†3,056	G 3
Sagamore	1,500	M 5
Salem	41,880	E 5
Salisbury	†2,695	L 1
Salisbury Beach	398	L 1
Sandwich	†2,418	N 5
Santuit	400	N 6
Saugus	†17,162	D 6
Saundersville	380	G 4
Savoy	†291	B 2
Saxonville	3,200	A 7
Scituate	†5,993	F 8
Scotland		L 5
Seekonk	†6,104	J 5
Segreganset	300	K 5
Sharon	†4,847	K 4
Shattuckville	225	D 2
Shawsheen Village	2,100	K 2
Sheffield	†2,150	A 4
Shelburne Falls	2,364	D 2
Sheldonville	300	J 4
Sherborn	†1,245	A 8
Shirley	†4,271	H 2
Shirley Cen.	1,082	H 2
Shrewsbury	†10,594	H 3
Shutesbury	†213	E 3
Siasconset	225	P 7
Silver Lake	2,024	L 5
Somerset	†8,566	K 5
Somerville	102,351	C 6
S. Acton	1,200	J 3
S. Amherst	750	E 3
S. Ashburnham	1,000	G 2
S. Athol	100	F 2
S. Attleboro		J 5
S. Barre	1,800	F 3
S. Berlin	200	H 3
S. Braintree	5,600	D 8
S. Bridgewater		L 5
S. Carver	300	M 5
S. Chatham	450	O 6
S. Dartmouth	6,300	L 6
S. Deerfield	1,418	D 3
S. Dennis	300	O 6
S. Duxbury	800	M 4
S. Easton	1,500	K 4
S. Egremont	415	A 4
S. Essex		L 2
S. Groveland	900	L 2
S. Hadley	†10,145	D 4
S. Hadley Falls	4,000	D 4
S. Hanover	600	L 4
S. Harwich	400	O 6
S. Hingham	650	E 8
S. Lancaster	1,462	H 3
S. Lawrence	25,000	K 2
S. Lee	325	A 3
S. Lincoln		J 3
S. Middleboro	600	L 5
S. Middleton		D 5
S. Natick	1,500	A 7
S. Orleans	89	O 5
S. Royalston	415	F 2
S. Sandisfield		B 4
S. Sudbury	900	J 3
S. Vernon	225	D 2
S. Walpole	750	K 4
S. Wareham		L 5
S. Wellfleet	450	P 5
S. Westport	200	K 6
S. Weymouth	8,500	E 8
S. Worthington	50	C 3
S. Yarmouth	1,185	O 6
Southampton	†1,387	C 4
Southboro	†2,760	H 3
Southbridge	†17,519	G 4
Southfield	100	B 4
Southville	300	H 3
Southwick	†2,855	C 4
Spencer	†7,027	F 3
Springfield	162,399	D 4
State Line	200	A 3
Sterling	†2,166	G 3
Still River	150	H 3
Stockbridge	†2,311	A 3
Stoneham	†13,229	C 6
Stoughton	†11,146	K 4
Stow	†1,700	H 3
Straits Pond	250	F 7
Sturbridge	†2,805	F 4
Sudbury	†2,596	A 6
Sunderland	†905	D 3
Sutton	†3,102	G 4
Swampscott	†11,580	E 6
Swansea	†6,121	K 5
Swansea Center		K 5
Taunton	40,109	K 5
Teaticket	600	M 6
Templeton	†4,757	F 2
Tewksbury	†7,505	K 2
Thorndike	1,650	E 4
Three Rivers	2,359	E 4
Tolland	†107	B 4
Topsfield	†1,412	L 2
Townsend	†2,817	H 2
Townsend Harbor	197	G 2
Truro	†661	O 5
Tully		E 2
Turners Falls	5,179	D 2
Tyngsboro	†2,059	J 2
Tyringham	†235	A 4
Unionville	150	J 4
Upton	†2,656	H 4
Uxbridge	†7,007	H 4
Vineyard Haven	1,864	M 7
Waban	6,000	B 7
Wakefield	†19,633	C 5
Wales	†497	F 4
Walpole	†9,109	B 8
Waltham	47,187	B 6
Waquoit	400	M 6
Ward Hill	580	K 2
Ware	†7,517	E 3
Wareham	†7,569	L 5
Warren	†3,406	F 4
Warwick	†429	E 2
Washington	†281	B 3
Watertown	†37,329	C 6
Waterville	450	F 2
Waverley	10,000	B 6
Wayland	†4,407	A 7
Webster	†13,194	G 4
Wellesley	†20,549	B 7
Wellesley Hills	18,000	B 7
Wellfleet	†1,123	O 5
Wendell	†342	E 2
Wendell Depot		E 2
Wenham	†1,644	L 2
W. Acton	1,300	H 3
W. Auburn		G 4
W. Barnstable	750	N 6
W. Berlin	325	H 3
W. Boxford	400	K 2
W. Boylston	†2,570	G 3
W. Brewster		O 5
W. Bridgewater	†4,059	K 4
W. Brookfield	†1,674	F 4
W. Chatham	300	O 6
W. Chelmsford	300	J 2
W. Chesterfield	200	C 3
W. Concord	1,285	A 6
W. Cummington	180	B 3
W. Dennis	600	O 6
W. Dudley	200	F 4
W. Falmouth	700	M 6
W. Granville	200	C 4
W. Groton		H 2
W. Hanover	1,200	L 4
W. Harwich	400	O 6
W. Hawley	56	C 2
W. Mansfield	900	K 5
W. Medway	1,625	J 4
W. Millbury	300	G 4
W. Newbury	†1,598	L 1
W. Newton	15,000	B 7
W. Peabody	1,100	D 5
W. Pittsfield	2,000	A 3
W. Rutland		F 3
W. Springfield	†20,438	D 4
W. Stockbridge	†1,165	A 3
W. Tisbury	†347	M 7
W. Townsend	900	H 2
W. Upton	1,400	H 4
W. Wareham	800	L 5
W. Warren	1,244	F 4
W. Yarmouth	1,355	N 6
Westboro	†7,378	H 3
Westfield	20,962	D 4
Westford	†4,262	J 2
Westford Sta.	300	J 2
Westhampton	†452	C 3
Westminster	†2,768	G 2
Weston	†5,026	B 6
Westport	†4,989	K 6
Westport Pt.	500	K 6
Westwood	†5,837	B 8
Weymouth	†32,690	D 8
Whately	†939	D 3
Wheelwright	270	F 3
Whitinsville	5,662	H 4
Whitman	†8,413	L 4
Wilbraham	†4,003	E 4
Wilkinsonville	400	G 4
Williamsburg	†2,056	C 3
Williamstown	†6,194	B 2
Williamstown Station	5,000	B 2
Willimansett	9,474	D 4
Wilmington	†7,039	C 5
Winchendon	†6,585	F 2
Winchendon Springs	500	G 2
Winchester	†15,509	C 6
Windsor	†372	B 2
Winthrop	†19,496	D 6
Woburn	20,492	C 6
Woods Hole	750	M 6
Woodville	350	H 4
Worcester	203,486	H 3
Woronoco	501	C 4
Worthington	†462	C 3
Wrentham	†5,341	J 4
Yarmouth	†3,297	O 6
Yarmouth Port	330	N 6

† ... tion of Town [Township.]

VARIED LANDMARKS OF THE OLD BAY STATE





'Gloucester Fisherman' (upper left) is a memorial to the men who lost their lives in Gloucester's great fishing fleets. It was executed in bronze by Leonard Craske. The Cape Cod Canal (upper right) offers coastwise shipping a safe short-cut between Buzzards Bay and Cape Cod Bay. The State House (lower left), built in 1795, crowns Beacon Hill in Boston.

caught on the Newfoundland banks. From the West Indies and from Spain the ships brought back sugar, molasses, and other valuable cargo. The colonists used the molasses for making the famous Medford rum. Thus Massachusetts became a commercial center.

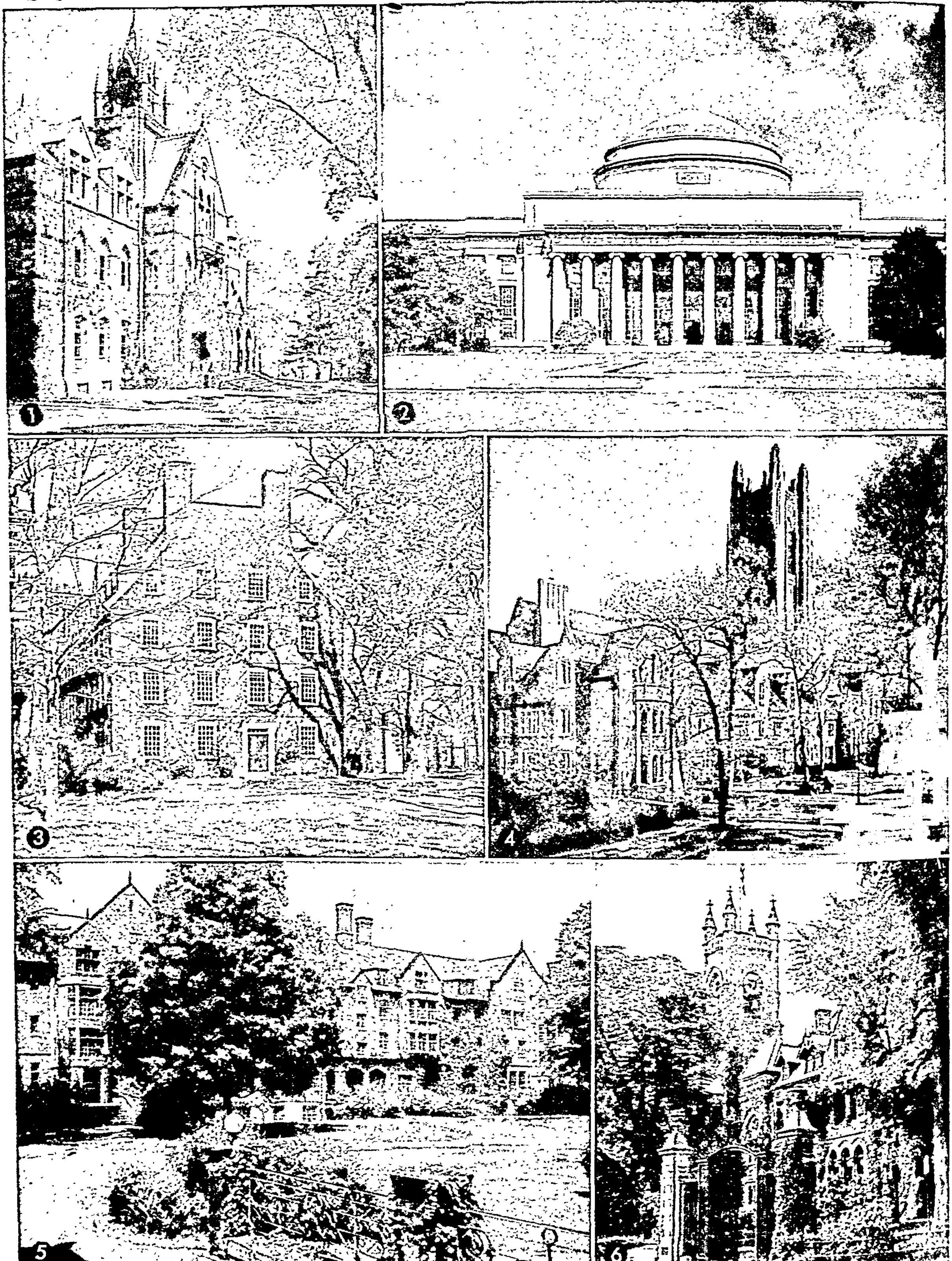
In 1784 an enterprising Salem shipowner sent a vessel to Russia. A year later the romantic and profitable trade with China and the Orient began. Whaling was once a prominent industry of New Bedford and Nantucket, and Nantucket was the whaling capital of the world.

Massachusetts is interesting also for the fact that it was the cradle of many American institutions and enterprises. The first free public school was founded there in 1635, and 1636 saw the beginning of Harvard College. Massachusetts is still a leader in the number of its colleges and academies of high rank. The town meeting so widely used in local government was first set up in Massachusetts. The first printing done in the English colonies in America was at Cambridge in 1639. In 1814 the cotton industry was revolutionized by the construction and operation at Waltham of the first power loom in America.

Hills, Valleys, and Seacoasts

In Massachusetts as in every state, geography has greatly influenced the course of

SOME FAMOUS MASSACHUSETTS COLLEGES



In the number of its excellent colleges, Massachusetts stands high in the nation. 1. The Administration Building at Amherst. 2. The entrance to Massachusetts Institute of Technology. 3. Harvard's Massachusetts Hall, one of the oldest college buildings in the United States. 4. The Administration Building at Wellesley College for Women. 5. Rockefeller Hall, a dormitory at Mount Holyoke College. 6. College Hall at Smith College.

development. In the western end of the state are the Berkshire Hills. This region gives rise to many small rivers. None of them are navigable but they furnish power to several manufacturing towns. The beauty of the region has made it a famous resort center. Notable for its scenery is Highway Route No. 2, which follows the old Mohawk Trail through here.

In the northwest corner of the state is Mount Greylock. It rises to a height of 3,491 feet, the highest elevation in Massachusetts. A few miles east is Mount Hoosac. Beneath it the famous Hoosac Tunnel burrows for almost five miles.

The hills of Massachusetts offer a thin, rocky soil, difficult to cultivate. As a result many people turned to manufacturing. In this work they were aided by abundant water power and fine natural harbors for shipping. Today only about 2 per cent of the state's workers are engaged in agriculture. The production of dairy products, chickens, and eggs accounts for about half of Massachusetts' farm income. Tobacco is raised in the Connecticut Valley. The sandy soil around Cape Cod is ideal for raising cranberries, in which the state leads the nation.

The seacoast is as picturesque as the hills. Cape Cod, stretching out like an arm doubled at the elbow, is the most prominent feature of our whole Atlantic coast line, and its quaint towns are favorites with the summer residents. For fishermen, Cape Cod is like a great pier from which they may stretch their nets. And for Boston it forms a breakwater such as the state could never have built with any amount of money. A canal from Cape Cod Bay to Buzzards Bay removes the dangers to coastwise shipping which have made the cape a name of ill omen (*see* Cape Cod). The islands of Martha's Vineyard and Nantucket—the one about 23 miles long and the other 15—are outlying parts of Massachusetts. Until 1820 what is now the state of Maine was a part of Massachusetts, and for a time the province of New Hampshire was joined to this greatest of the New England colonies.

The Founding of Massachusetts

Religion played an important part in the founding of Massachusetts. The first permanent settlers who landed at Plymouth in 1620 had broken away from the Church of England and were therefore called Separatists. Leaving England, they spent a brief time in Holland before sailing to America (*see* Mayflower; Plymouth). This small group of men, women, and children became known as the Pilgrims. They established the first self-governing community in America.

Following the Pilgrims, there began the "great migration" of Puritans to the New World, of whom about 14,000 settled in Massachusetts. They belonged to the religious group that wanted to "purify" the teachings and ceremonies of the English Church. Their first important settlement was established at Salem under John Endicott in 1628. The following year John Winthrop obtained from King Charles I the charter which created the Massachusetts Bay Company, and in 1630 Puritans established settlements at Charlestown, Boston, and neighboring places.

The Puritans believed that the purpose of their government was to enforce laws which God had given them in the Bible. Some of these laws were believed to apply to the church, while others regulated business, family affairs, and even clothing. Anyone whose religious views differed from those of the Puritans was regarded as a lawbreaker. Usually such people were banished from the colony. For those suspected of being witches, the ducking stool and the gallows were provided.

Thomas Hooker of Cambridge, unable to agree with his fellow Puritans, set out for freedom with his congregation and in 1635 planted the first settlement in Connecticut at Hartford. Rhode Island was first settled in 1636 when Roger Williams, banished from Massachusetts for his beliefs, founded Providence. John Wheelwright was also exiled, and journeyed to New Hampshire where he settled Exeter in 1638.

In spite of the Puritans' strange concept of personal freedom, they made an important contribution to the development of political freedom. Their "town meetings" became a model for later democratic forms in America. The royal charter had made it possible for the entire government of the colony to be transferred from England to Massachusetts. This unique advantage was abolished when the charter was revoked in 1684, but it had served to plant the idea of independence (*see* American Colonies).

After Charles II revoked the charter, Massachusetts and all the northern colonies were put under the Dominion of New England. Under William and Mary in 1691 Massachusetts was made a royal colony with the governor appointed by the crown.

Crown laws denied the colonies the manufacture of essential goods. Massachusetts did not have rich enough soil to gain prosperity from agriculture. It turned to the sea. By 1700 its fishermen were off Newfoundland, its sea captains were sailing the oceans of the world. Massachusetts became the carrier for all America, building more ships than England. A sinister aspect of this seafaring activity developed in the famous triangular trade. The ship owners exchanged colonial rum for African slaves, then traded the slaves in the West Indies for sugar and molasses to make the rum (*see* Providence).

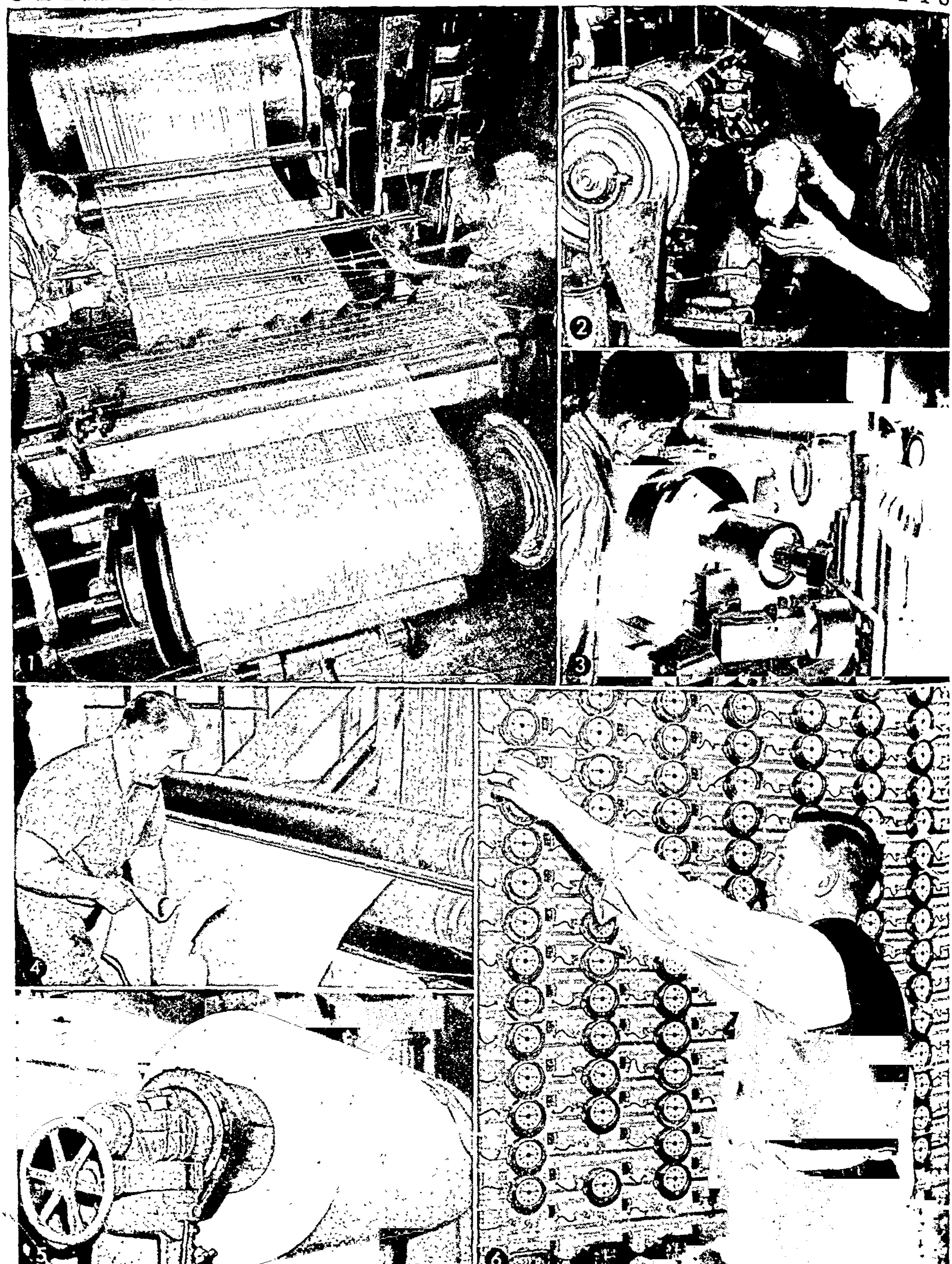
War of the Revolution

Many of the acts that led up to the American Revolution occurred in Massachusetts. Its merchants were particularly sensitive to the taxes and controls on commerce imposed by the Crown. These included the Sugar and Stamp Acts and the taxes to help pay for the French and Indian Wars and to maintain defenses on the frontiers (*see* French and Indian Wars).

Boston merchants, hard hit, boycotted English goods. The acts were repealed. Other revenue measures followed, however, and angry mobs in Boston brought on clashes between citizens and troops, which reached a climax in the Boston Massacre in 1770 (*see* Revolution, American).

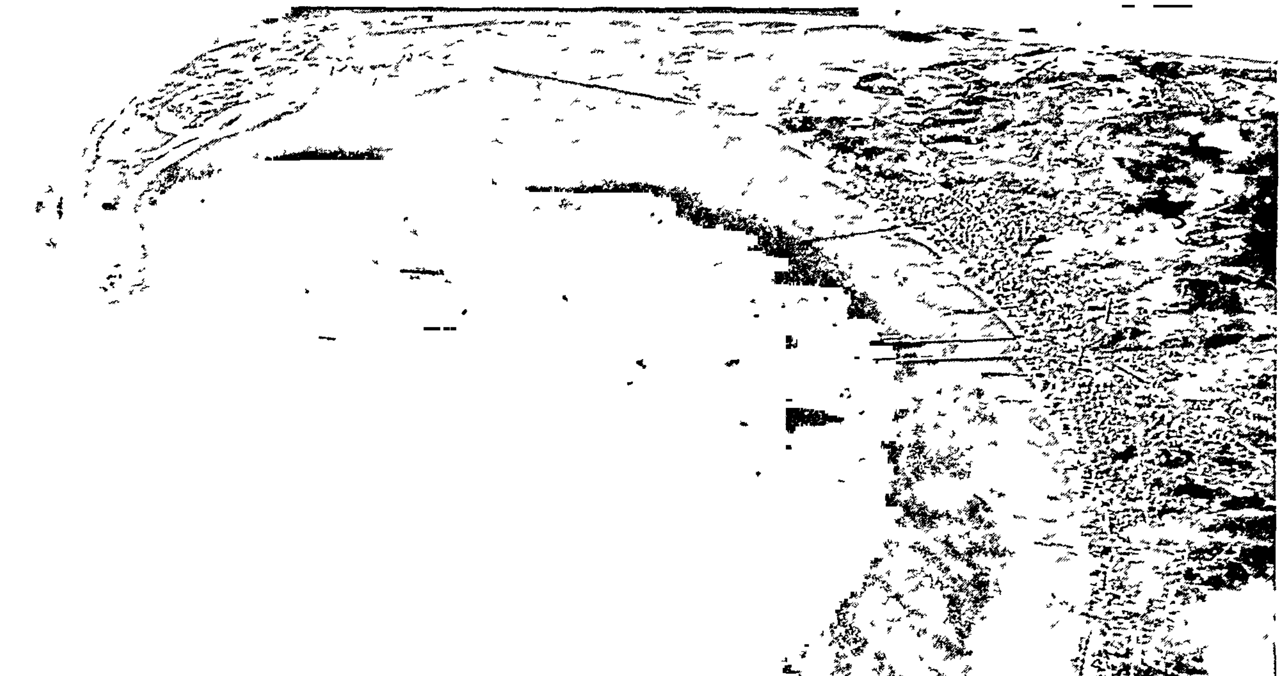
The Tea Act followed. Goaded by Samuel Adams, hotheaded Bostonians boarded three ships of the East

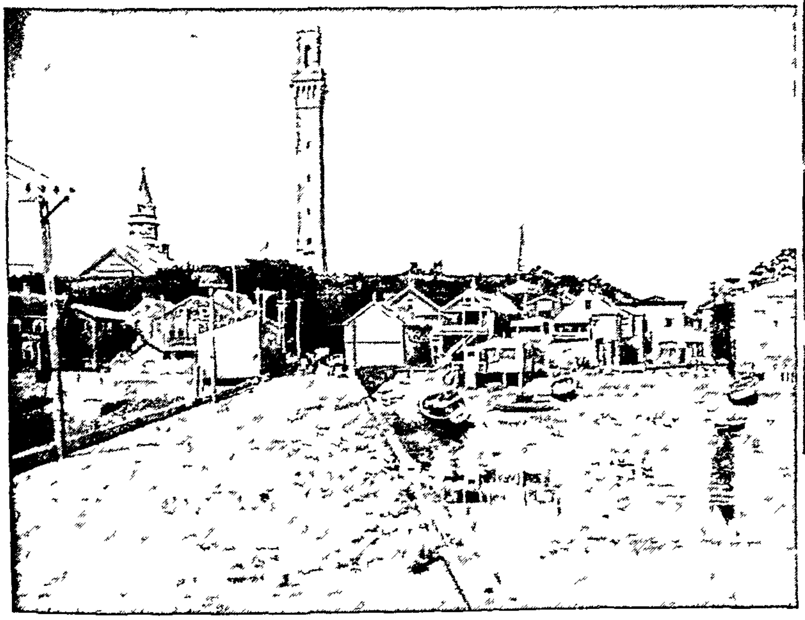
GLIMPSES OF INDUSTRY IN MASSACHUSETTS



Massachusetts has been a constant leader in the development of modern production methods. 1. In a textile mill, a slashing machine applies sizing to the warp threads in preparation for weaving. 2. In a shoe factory soles are being stitched; Massachusetts makes almost *one fifth of the shoes* in America. 3. A large turret lathe at work in a machinery factory. 4. Softening the hides in a tannery—one of the old enterprises of the state. 5. A roll of paper, just finished, in one of the large paper mills. 6. In a watch and clock factory a group of automobile clocks are being adjusted for correct time.

PROVINCETOWN IN THE SHELTER OF CAPE COD'S SANDY ARM





Cape Cod's arm bends toward Long Point—its fingertip—in the top picture. Along the inner shore straggles Provincetown, fishing village in winter and art colony and tourist resort in summer. The bottom picture shows part of the water front and the granite tower, dedicated in 1910 to commemorate the landing of the Pilgrims and the signing of the Mayflower Compact.

India Company and dumped their cargoes of tea into the bay. This was the Boston Tea Party (1773). Minutemen were being drilled, and two years later on the village green at Lexington and at Concord they fired on the troops of General Gage, who was military governor of Massachusetts (*see* Lexington and Concord, Battle of; Concord). The first major battle of the war was fought at Bunker Hill near Boston in June 1775 (*see* Bunker Hill, Battle of). Colonial reinforcements bottled up the British in Boston. Washington laid siege to the city, and the British and many Tories left by sea in March 1776. For the rest of the war Massachusetts was free of British troops.

Between 1777 and 1779, Massachusetts drafted the first state constitution to be tested by popular vote. The state experienced its own "revolution" after the war, when Berkshire farmers organized Shays' Rebellion in 1786. Daniel Shays led the rebels toward Boston, but the uprising was quickly quelled (*see* Shays' Rebellion). In 1788 the state ratified the Federal Constitution. It is one of the states which designate themselves as "commonwealths" rather than "states."

Commercial Leadership

Wealth soon came from merchant ships. Strange cargoes from Eastern lands were offered at the wharves. The whaling industry grew and became a picturesque feature of Massachusetts life. In its new prosperity the state supported the aristocratic Federalist party and vigorously opposed President Jefferson and the Embargo Act (*see* Embargo Acts). It also opposed the War of 1812 and refused to let its militia leave its borders. Feeling ran so high that at the Hartford

Convention in 1814, Massachusetts and the other New England states discussed secession from the Union. But the very embargo policy which had crippled the trade in English goods, fostered American manufacturing. And a great many of the new factories arose in Massachusetts. The people had long been skillful in handicrafts. Water power for the mills was abundant. Many farmers were eager to leave their unproductive farms for the new factories. When steam power was introduced, the foundation of a strong industrial commonwealth was laid.

Soon there appeared the first influx of the great Irish immigration. Other European peoples were to add to this wave during the 19th century. At the same time thousands of natives of the state were moving into the West to add a bit of the Massachusetts spirit to the making of the new American communities.

The Abolitionists and the Civil War

Under the force of all these new currents, the old Puritanism was dissolving and liberalism was growing. Massachusetts became intellectual and restive. Social experiments were generated. And chief of these reforms was the Abolitionist movement. Despite its share in the development of the slave trade, New England had had no occasion to use slave labor on a large scale. So the movement had little opposition at home. For 30 years the Abolitionist press directed its campaign against the South and created a state of agitation throughout the Union (*see* Garrison, William Lloyd).

When the Civil War started Massachusetts was the first state to respond to Lincoln's call to arms. Its blood was first to be spilled when the Sixth Regiment was attacked in Baltimore (*see* Civil War, American).

Modern Massachusetts

After the war Massachusetts shipping suffered a gradual decline, but its industries continued to attract large groups of immigrants from Europe. The old-line New Englanders, the farmers and dwellers in the smaller towns, tended to cling to the Republican party. The newcomers, crowded into the large industrial cities, turned toward the Democratic party. In time the balance between the two in Massachusetts became a decisive factor in presidential elections.

The state continued to hold a key position in the nation's economy. Though other states surpassed it in volume of manufactures, Massachusetts maintained a high place in production of fine tools, machinery, and other products requiring skilled craftsmen.

Intellectual culture in the Bay State kept pace with its material prosperity. The ground work for its culture had been laid when Harvard College was founded in 1636 and a public school system later developed (*see* Education). In the 19th century it was the literary and intellectual center of the United States. Foremost among its poets, writers, and philosophers are the names of Emerson, Hawthorne, Thoreau, Whittier, Holmes, Bryant, Frost, Emily Dickinson, James Russell Lowell, Amy Lowell, and many others (*see* American Literature).

Its heritage of culture is witnessed by its colleges and universities. After Harvard came Williams at Williamstown (1793); Amherst at Amherst (1821); Holy Cross at Worcester (1843); Tufts at Medford (1852); Massachusetts Institute of Technology, first at Boston (1861) and later at Cambridge; University of Massachusetts at Amherst (1863); Clark University at Worcester (1887). Colleges for women include Mount Holyoke at South Hadley (1836); Wellesley College at Wellesley (1870); Smith College at Northampton (1871); Radcliffe College (1879), later affiliated with Harvard; Simmons College at Boston (1899).

(*See also* chronology in Massachusetts Fact Summary; United States, section "New England.")

The MARVEL *of* MATCHES *and How They Are Made*

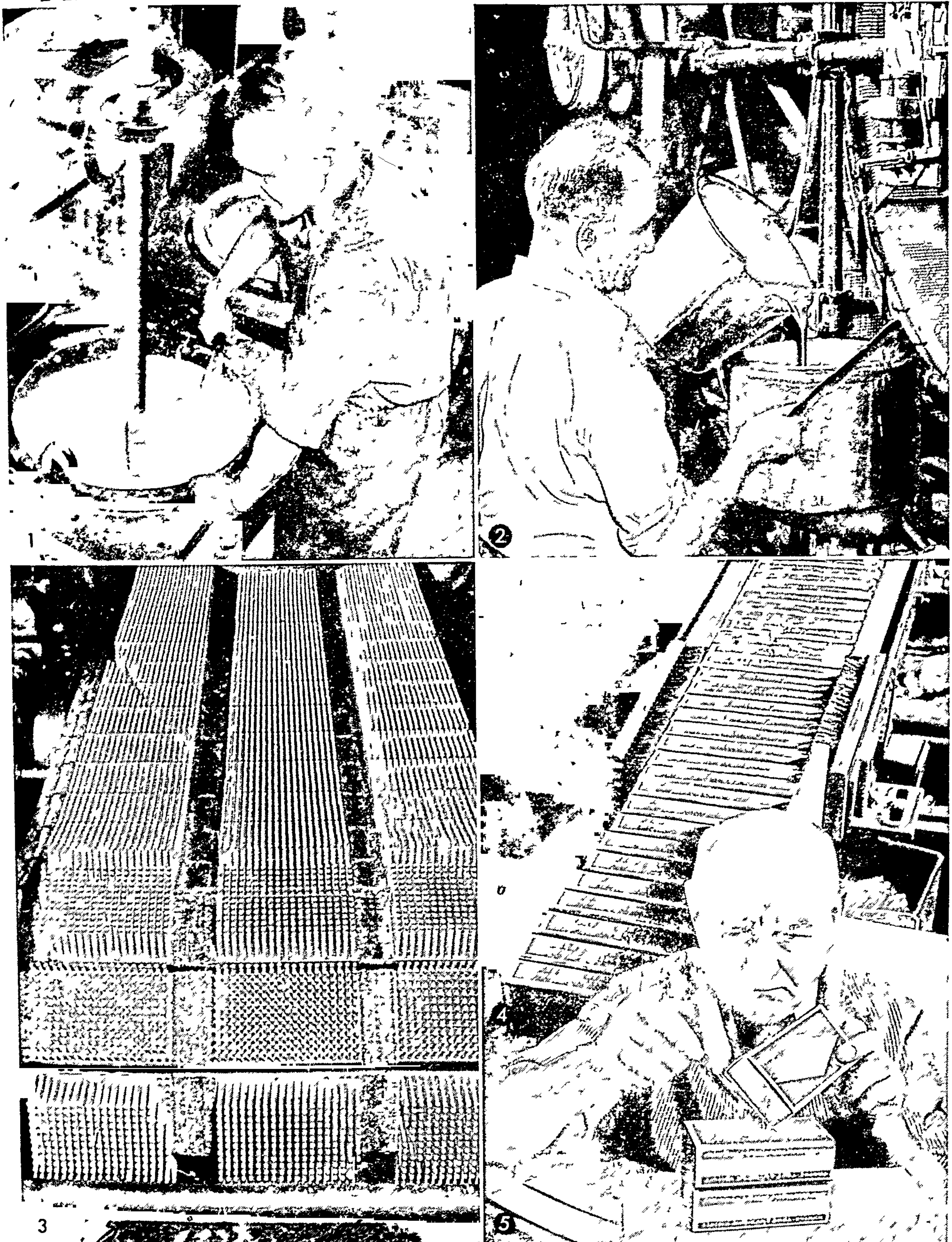
MATCHES. Before matches were invented it was a solemn thing to watch the father of the family start a fire. He took a little iron box down from the high mantel shelf. Inside of it were a bar of steel, a flint stone, and a bit of charred linen or "tinder." He struck the steel on the flint and a starry spark flew off on the tinder. Slowly the glow spread over the tinder until, by blowing on it and feeding it with shavings and splinters, it burst into flame.

It was such trouble to start a fire with flint and steel that live coals were kept over night under ashes. If a fire went out a little boy was likely sent with an iron kettle to borrow fire of a neighbor a mile or so away. Hunters who lost their tinder boxes were sometimes forced to start camp-fires as the Indians did, by rubbing two sticks together. Any one who has got his supply of matches wet while on a camping trip will understand what a convenience matches are, and will understand why the practiced woodsman keeps his matches in a waterproof box or bottle, and guards them with even greater care than his food.

It had long been known that phosphorus, sulphur, and certain chemical compounds catch fire at low temperatures, but the friction match was not invented until 1827, and the first really practical matches were not put on the market until 1833. For many years most matches were tipped with an evil-smelling mixture of white phosphorus and sulphur. Since white phosphorus gives off highly poisonous vapors which produce the terrible "phossy jaw" disease once common in the match industry, its use has been prohibited in the leading countries of Europe and made impossible in the United States by heavy taxation (*see* Phosphorus). The inflammable tips now usually contain sesquisulphide of phosphorus, together with other substances that promote rapid combustion.

"Safety matches," which will not easily ignite except when rubbed against the chemically prepared strip on the side of the box, are usually tipped with quick-burning chemicals such as chlorate of potash, while the phosphorus is in the mixture on the rubbing surface of the box. In some European countries "vestas"

THE EVOLUTION OF A MILLION MATCHES



1 These machines stir and mix the chemicals for match heads which include chlorate of potash, phosphorus compound, glue, starch, and pulverized quartz. 2. The mixture feeds into the dipping machine. 3 Moving on belts the blocks of match sticks dip their tips into the chemicals which form the match heads as they dry. These 2⅛-inch splints are cut by razor-like blades from blocks of wood and treated to make them burn well. There are 1,368,000 splints in a chain. 4 A machine packs the matches in boxes 5. To check quality, a tester, lights 3,000 matches a day from sample boxes.

are much used. They have thin wax-covered wicks instead of wooden splints. Waxed cardboard is used for the "sticks" of most pocket matches in America.

Matches are made by continuous match machines without the aid of a human hand. For wooden matches, seasoned blocks of white pine of match-length thickness are fed into these machines. As the blocks are fed in, rows of hollow dies gouge into them and stamp out the round match splints. Some machines cut 50 splints at every revolution and revolve 300 times a minute, making 15,000 splints a minute, or 900,000 an hour; others work even faster. On the upward stroke of the dies the little sticks are forced into holes in drilled metal plates, which hold them tightly. The mark of the plate shows on the lower end of each match. These plates are hinged together to form a long endless chain, which carries the splints along from one process to another.

First the sticks go into a chemical bath which prevents afterglow when the match is burned. Then they are dried and carried through a vat of melted paraffin, which makes them burn readily. The head is made by two "dips." The first, or bulb, dip contains chemicals that will not ignite under ordinary friction and the second forms the sensitive tip. After being dried by blasts of air the finished matches are pushed out of the plates and packed in boxes by automatic machinery.

Each box is packed as tightly as possible, and the matches are arranged in two layers with the heads in opposite directions. Thus if a case of matches is dropped very hard, usually only half the matches in any box will light, and the fire dies out when the supply of oxygen is exhausted.

According to some estimates, the world uses 4 trillion or more matches a year, or about 2,000 a year for every one of its inhabitants. The United States, one of the world's chief producers, sometimes uses more than 400 billion a year. Sweden, Soviet Russia, and Japan are usually the leading foreign producers.

MATHEMATICS. Men can live in a primitive way without much ability to count or measure. But even a civilization on a rude level requires both abilities; and by the dawn of historic times about 5,000 years ago, men had developed the foundations of arithmetic and geometry. Today these subjects and the higher developments in the field make up the science of *mathematics.*

Without mathematics, our modern machine and electrical age would be impossible. We could not design jet planes, television sets, bridges, or machinery. We could not keep records or manage any business beyond the smallest. Mathematics ranks with reading and writing as one of the cornerstones of modern civilization.

Numbers, Arithmetic and Algebra

The basis of *arithmetic* is a system of numbers that are used to express quantities and the values of measurements. Men have had many different systems of numbers, but today most civilized peoples use the decimal system. The numbers represent definite values, such as 1, 5, 25, and 150, and arithmetic uses these numbers in various operations, such as addition and multiplication, to obtain answers to problems (*see* Arithmetic; Number System).

In many cases, however, certain facts about a quantity or number are known, while the quantity or number itself is not. The problem is to find its value. Procedures used for working such problems constitute *algebra.* A typical algebraic procedure starts by saying, "let x = the unknown number." Then it states the known facts in terms of x and finds the value of x.

Geometry and Trigonometry

Geometry deals with the properties of plane figures and solid objects. *Plane geometry* deals with problems that can be worked out on flat surfaces. *Solid geometry* deals with objects in space such as cubes and spheres (*see* Geometry).

A special branch of geometry called *trigonometry* deals with the properties of triangles. For example, if two angles of a triangle are known, together with the length of the side between them, the value of the remaining angle and other sides can be calculated by using trigonometry. Therefore surveyors can use observations from a measured base to determine distances across a river, or between mountain peaks on the horizon.

Trigonometry applied to flat surfaces, such as the land within a county, is called *plane* trigonometry. *Spherical* trigonometry provides methods for dealing with problems on the surface of a sphere, such as the earth, and what appears to be the "dome" of the sky. These methods can be used for mapping large areas such as continents, for navigation of ships and airplanes, and for astronomical observations (*see* Astronomy; Navigation; Surveying; Trigonometry).

Graphs and Analytical Geometry

One of the simplest ways to present many kinds of statistical or other facts is by the use of graphs (*see* Graphs and Charts). Graphs are a visual presentation of mathematical data.

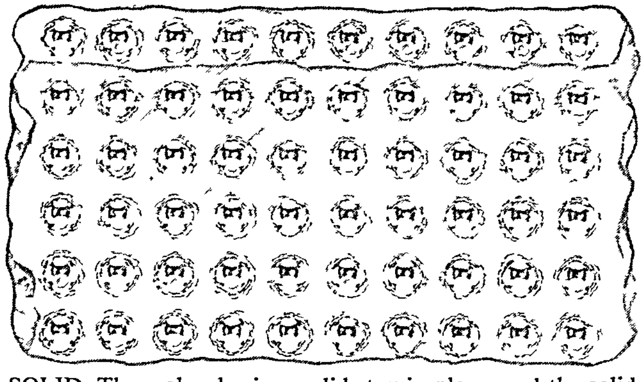
Analytical geometry is based upon the fact that any geometric figure can be expressed in an algebraic equation. For example, the area of a square (y) or the volume of a cube (z) having x as one edge can be expressed as $y=x^2$ or $z=x^3$. Thus algebraic computation can be used instead of complicated geometric figures.

How Calculus Serves Modern Science

Many important quantities in nature are changing constantly. Examples are the temperature of an iron bar as it is heated or cooled and the fluctuations of current and voltage, perhaps a million times a second, in an electronic device. The methods for expressing and using such variable quantities make up the subject of *calculus.*

With calculus, scientists can guide and test their efforts with help from far-reaching, powerful mathematical methods. Calculus is as helpful and necessary a tool as any experimental procedure used in the physical sciences (*see* Calculus).

MATTER—
The "BUILDING STUFF" *of the* UNIVERSE



SOLID. The molecules in a solid stay in place, and the solid holds its shape. But the molecules have energy and vibrate in place, as shown in red.

MATTER. The air we breathe, the water we drink, the wood in furniture, and the steel in automobiles are all made of matter. Most of our means of living, as well as our life processes, depend upon interactions between matter and energy. Likewise much of human progress depends upon knowledge of matter and its transformations. The Indians who occupied North America long ago had the same raw materials that we do. Many great differences between the way they lived and the way we live come from our greater knowledge of how to make matter do what we want it to do.

Matter exists in millions of forms, from the clouds in the sky and our food and clothes to the soils, waters, and rocks of the earth. In response to physical forces, such as gravitational attraction and heat, most of these forms may be treated as belonging to one of three *states*, or *phases*, of matter—*solid, liquid,* or *gaseous.*

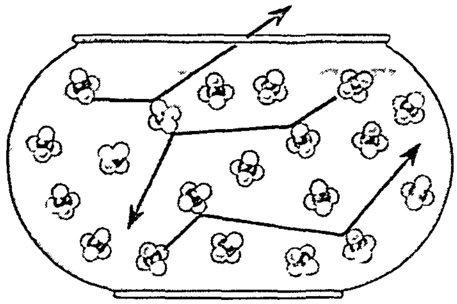
Common States of Matter

A solid has a fixed shape and volume. In the liquid state, matter has a fixed volume but no fixed shape. It takes the shape of the container which holds it. In the gaseous state, matter has neither fixed shape nor volume. It will spread through all the space available to it.

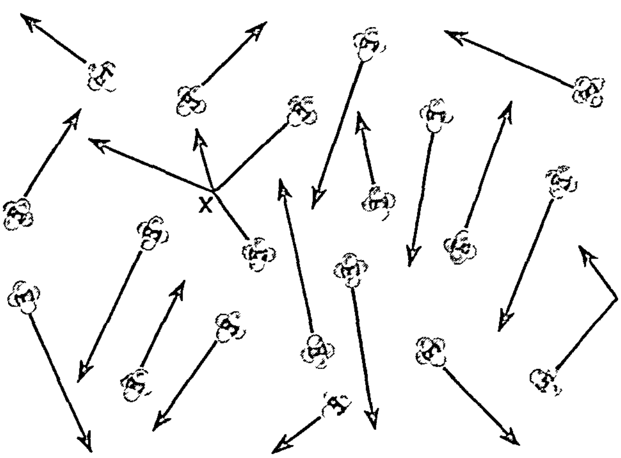
Some kinds of matter are not entirely solid, liquid, or gaseous. Our gaseous atmosphere has tiny, solid particles of dust dispersed throughout it. Fog is air loaded with tiny droplets of water (liquid). India ink consists of tiny solid particles of carbon suspended in water, and mayonnaise is a liquid with countless bubbles of air beaten into it. Such combined states of matter are called *colloids.*

Many substances change from one state to another at definite temperatures; others do not. Glass does not melt at a particular temperature. As it gets hotter, it merely gets softer. When wood or chalk (calcium carbonate) is heated, it decomposes instead of melting.

The dry ice (solid carbon dioxide) used for packing ice cream does not melt. It changes directly from a solid to a gas. This change is called *sublimation.* Ordinary ice melts at 32° F. or more, but it also sublimes at temperatures below freezing.



LIQUID. The molecules in a liquid hold loosely together but move about (three tracks are shown in red). This freedom lets the liquid take the shape of its container.



GAS. The molecules of a gas fly about at high speed but collide constantly, as shown at X. After each collision, they spring apart and fly on to the next collision.

Because liquids and gases flow, both are called *fluids.* Although either kind of fluid flows almost freely, there is some friction when an object is moved through a fluid or a fluid flows through a pipe. Fluid friction is called *viscosity.* Molasses is a very viscous liquid, while air and other gases have small viscosities. Despite this, much energy may be needed to overcome gaseous friction, as in piping natural gas from wells to consumers.

Organization of Matter in Atoms and Molecules

The states of matter and changes from one state to another depend first of all upon the structure of matter. All matter is made up of different kinds of particles called *atoms,* and these particles are made up of still smaller parts called protons, electrons, and neutrons. The arrangement of particles within

each kind of atom gives that kind its distinctive properties (*see* Atoms; Chemistry).

Electric forces bind atoms together either with others of the same kind or with different kinds. The combinations usually have properties very different from those of the atoms they contain. For example, carbon atoms can form a hard, gleaming diamond, a softer solid called coal, a soft, greasy material called graphite, or tiny particles called soot.

Carbon also can form various combinations with hydrogen, oxygen, and nitrogen. Carbon and hydrogen form marsh gas, or methane (CH_4). Carbon and oxygen form carbon dioxide (CO_2) or carbon monoxide (CO). In contrast, atoms of carbon, hydrogen, and oxygen can combine to make *sugar*. If some atoms of nitrogen, and occasionally other elements, unite in suitable arrangements, the result is *protein*, the food which provides "framework" for living tissues.

These examples suggest that larger masses of matter usually consist of atoms in combinations rather than separate atoms. It is plain also that there must be a "smallest piece" of each combination. This has the smallest number of atoms which will give the particular kind of matter its distinctive properties. Such "smallest pieces" are called *molecules*. Small molecules are generally a few billionths of an inch across; but some complex molecules in living tissues are thousands of times this big.

The Nature of Cohesive Force

Like nearly all atoms, most kinds of molecules exert electrical force outside themselves. An attraction which binds molecules of the same kind is called *cohesive* force. If the molecules are unlike, the attraction is *adhesive* force. The nature and strength of these forces, together with the amount of heat in the molecules, determine whether a given mass of molecules is a solid, a liquid, or a gas.

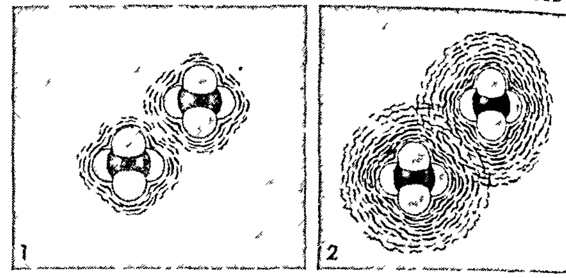
The strength of cohesive force depends upon the kinds of molecules and how far apart they are. The centers of neighboring molecules of iron are about two billionths of an inch apart, and strong cohesive force tends to hold the molecules together firmly except at very high temperatures. In contrast, the cohesive force between molecules of hydrogen is not enough to bind them together except at very low temperatures. Therefore, hydrogen molecules fly about singly as a gas at an average distance apart of about 1/140,000 of an inch between collisions.

The Kinetic Theory and Changes of State

In all kinds of matter, the molecules and atoms are in constant motion. Even in solids, every molecule vibrates ceaselessly. This "energy of motion" is what we call *heat;* its intensity is measured by *temperature.* That the molecules and atoms of matter are in ceaseless motion and that this motion constitutes heat are a basic part of the *kinetic theory of matter*. (*See also* Heat.)

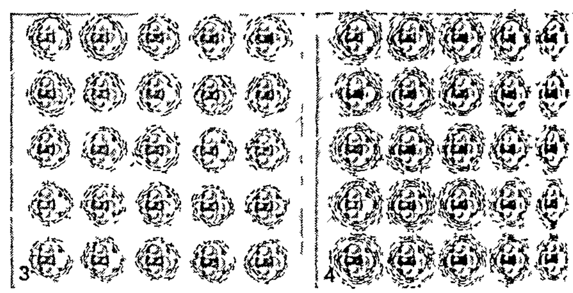
Gain or loss of heat energy (or molecular motion) can change matter from one state to another. For example, at very low temperatures, the molecules in a solid vibrate very weakly. Additional heat energy

HOW COHESIVE FORCE WORKS IN SOLIDS



1. The cohesive force exerted by these molecules (indicated by white areas) weakens with distance from the molecule. Each molecule is within the zone of force exerted by the other; and the vibration (or heat energy) of each molecule (red) is not strong enough to break them apart.

2. Added heat energy has increased the vibration, and cohesive force can barely hold the molecules together.



3. One molecule in a solid is shown with its zone of strong cohesive force extending past all its neighbors and holding them firmly. They too exert cohesive force upon each other, and the solid is held together strongly.

4. With stronger vibrations, some neighbors of the central molecule can almost break away. If more heat energy is added, some break loose and the solid melts.

makes the molecules vibrate more vigorously. Given enough heat energy, some of them break loose and wander about in the mass. When this happens to a sufficient number, the solid *melts* to a liquid. (In science, melting is sometimes called *fusion.*)

As a liquid loses heat energy, the molecules move less vigorously. When they have lost energy enough, cohesive force can draw them together into a solid. This process is called *solidification,* or in water, *freezing.* (*See also* Freezing; Frost; Ice.)

A sufficient amount of heat energy can change a liquid to a gaseous state by driving molecules from the liquid surface into the open space above as *vapor.* This process is called *vaporization.* Sufficient loss of heat energy will change a vapor back to a liquid. This is known as *condensation.* (*See also* Dew; Fog; Liquid.)

Suitable application of pressure and extreme cooling can transform a gas into a liquid. This process is called *liquefaction.* Further cooling can change a liquid to a solid.

Properties of Solids

In a solid, each molecule is held to a small space by its neighbors. The molecules can still alter their position slightly, however; and the forces acting from outside the molecules can produce such changes without destroying the solid. The changes may not

be the same in all directions, because the cohesive force exerted by the molecules upon each other may vary in different directions.

Pulling a coiled spring extends it slightly. Doubling the pull, or *tension*, doubles the stretch. When the tension is released, the spring returns to its original length. The bonds between molecules have yielded slightly to pull, but remain strong enough to draw the molecules back when the tension is released. This "ability to return" is called *elasticity*. If the pull is strong enough the molecules will form bonds with new neighbors instead of old ones, and the spring remains lengthened. This occurs when the *elastic limit* of the material in the spring is exceeded.

In many materials the molecules can be squeezed together by pressure from outside, but they spring back to their usual space when the pressure is released. They are *elastic under compression.* Materials may differ, however, in resistances to tension and to compression. For example, cement resists compression well, but it is not always strong under tension. Materials also differ in ability to hold their shape under compression. A steel bar holds its shape, but rope will not. Rope can be pulled because it has high tensile strength, but it cannot be compressed easily. It changes shape too readily.

Some materials can be rolled or beaten very thin. Such materials are said to be *malleable* (from the Latin word *malleus* for "hammer"). For example, gold can be beaten into sheets (called foils) only four millionths of an inch thick. Similarly, a material such as gold which can be drawn out into thin wires is said to be *ductile* (*see* Gold). Solids also vary in *hardness;* that is, in ability to resist the entrance of other matter and to keep the surface from being scratched. (For a list of minerals arranged in order of hardness, *see* Minerals.)

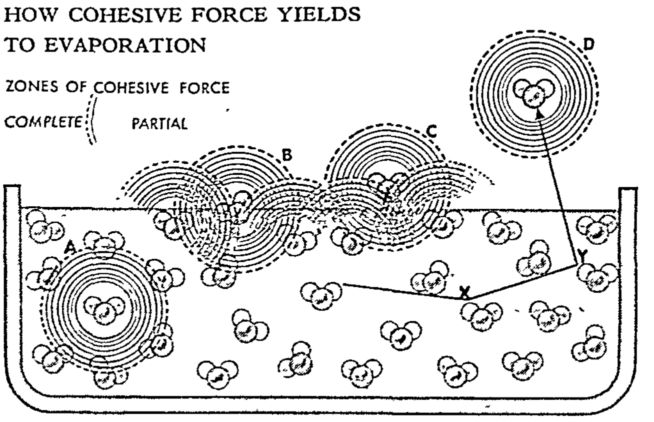
Pressure Exerted by Gases and Vapors

Many physical properties of gases and vapors, as well as changes between liquids and vapors, arise from the high speed of molecules in the gaseous state. Even at a temperature of 32° F., the average speed of oxygen molecules is about 1,500 feet a second. Lighter molecules, such as those of hydrogen, travel much faster; heavier molecules go more slowly.

The molecules in a gas, or in a mixture of gas and vapor, often collide with each other and with solid and liquid surfaces. Whenever they strike, they exert force; and the total force exerted upon any square inch or other unit of area amounts to *pressure* upon that area. In scientific work, pressure is often measured by ability to hold up a column of mercury (*see* Barometer). The relations between temperature, volume occupied, and pressure exerted by a gas are governed by a *general gas law*, but the law does not hold under extreme conditions (*see* Gas).

Transitions Between Liquids and Vapors

Vaporization occurs whenever molecules in a liquid gain energy enough to overcome a special pull at the liquid surface, called *surface tension.* This pull consists of cohesive force exerted by liquid molecules

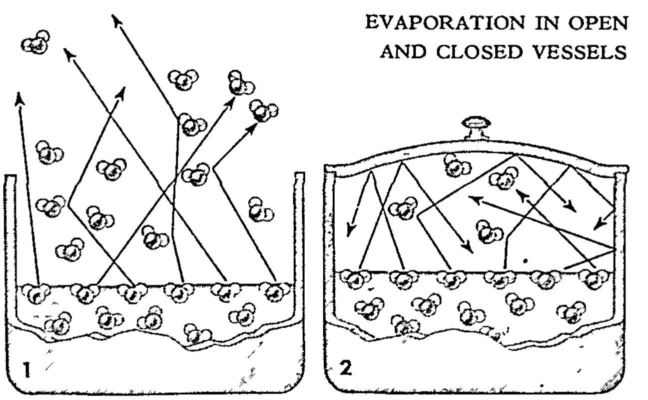


Molecule A in a liquid is held loosely to its neighbors by bonds of cohesive force (red). Molecules B and C at and just above the surface are still held by bonds that tend to draw them back. This "backward pull" is called *surface tension.* Molecule D has been given speed enough by collisions at X and Y to break away from surface tension and fly free. This "flying free" is called *evaporation.*

at or near the surface. A molecule can escape it by moving at a *greater* than average speed. This happens when chance collisions with other molecules give it the necessary speed and direction to counteract the cohesive force (*see* Liquid).

Vaporized molecules fly about freely and occupy much more space than they did before. When water is vaporized to steam at a temperature of 212° F., the average distance between the H_2O molecules becomes about 150 billionths of an inch, or twelve times what it was in the liquid state. This increases the volume occupied about 1,700 times. The molecules themselves do not expand. Usually they take up less than one thousandth of the total volume.

The most simple example of condensation from a vapor to a liquid state occurs when a flying vapor molecule strikes the liquid and is absorbed. But if the liquid surface is open to the air, most of the vaporized molecules fly away, and evaporation continues until all the liquid is gone.



1. These molecules are evaporating from a liquid in an open vessel. Since they encounter little that would drive them back, evaporation will continue until the liquid has disappeared. The escaped molecules form *vapor.*

2. Here some molecules are evaporating in a closed container, while others strike back into the liquid. When the "outgo" and "return" of molecules relative to the liquid are exactly even, the vapor is said to be *saturated.*

If the space above a liquid is enclosed, the molecules which escape from the liquid cannot fly away. They can only fly about in the enclosed space, striking other molecules, the enclosing surface, and the surface of the liquid. If the temperature is kept constant, a state of balance will soon be reached in which the number of molecules returning to the liquid is equal to the number which are escaping. The rates of vaporization and condensation will be equal. When such a state is reached, the vapor is said to be *saturated*. (*See* Liquid).

Process of Liquefaction

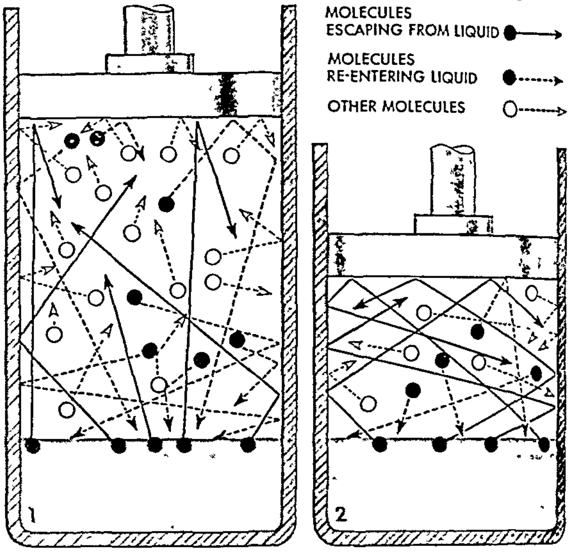
When a gas is cooled and subjected to a higher pressure, the speeds of the molecules are reduced and the molecules are brought closer together. With the right amount of cooling and pressure, the attractive forces between the molecules begin to be effective. If the cooling is continued, the molecules will begin to stick together, or liquefy, as droplets.

All gases can be liquefied, although it takes very low temperatures for such gases as hydrogen and helium. The temperature at which liquefaction occurs depends greatly on the amount of the attractive forces between the molecules. For platinum and iron the attractive forces are large enough so that gases of these materials liquefy at high temperatures. The attractive forces between helium molecules are so small that helium must be cooled to $-450°$ F. before it can be condensed.

One way to encourage a gas to liquefy is to lower the temperature. This reduces the speed of the molecules and gives the attractive forces a better chance of holding two colliding molecules together. Another way to encourage liquefaction is to increase the pressure. This brings the molecules closer together and increases the chance that several molecules will stick together in a droplet.

The accompanying diagram shows a fundamental difference between gases and vapors. At all ordinary temperatures on the surface of the earth, a *gas* obeys the general gas law. This means that if the volume it occupies is reduced to half while the temperature is held the same, the pressure it exerts is doubled. The diagram shows, however, that when a saturated *vapor* is compressed while the temperature is kept constant, the volume changes but the pressure does not. Enough vapor condenses to keep the pressure constant. Therefore, in a saturated vapor the pressure depends *only on the temperature* and not on the volume. The behavior of an unsaturated vapor is intermediate between these two reactions.

HOW PRESSURE AFFECTS VAPORS



1. This diagram shows molecules of a saturated vapor flying about in a cylinder equipped with a piston. On the average, the same number re-enter the liquid as leave it. *Condensation* is equal to *evaporation*.

2. Here the piston has been pushed down until it cuts the former space (or volume) in half. The decrease in volume pushed many vapor molecules back into the liquid, thus increasing condensation. If the temperature does not change, the compression reduces the number of vaporized molecules by half. The number in each *unit* of volume, however, is still the same and so is the vapor pressure.

Mass, Weight, and Conversion

Through all the changes of state which atoms or a given mass of molecules can undergo, certain basic properties persist. For example, matter always occupies space; that is, it has *extension*. Furthermore, every bit of matter, even a single electron, proton, or neutron, has a certain amount of substance. This amount of substance is called *mass*.

Mass is often thought to mean the same as "weight", because we commonly test the amount of mass in a portion of matter by weighing it. But the operation of weighing depends, directly or indirectly, upon the force of gravity pulling upon the matter; and this force is not the same everywhere. It is less, for example, on a mountaintop than it is at a seashore. If, therefore, an object is weighed with a spring scale, it will weigh less the higher it is above sea level, even though its *mass*, or amount of substance, remains the same. Mass can be tested, however, regardless of variations in the force of gravity, by weighing the object in question on a balance against known amounts of mass called *standard weights*. (*See also* Mechanics.) Variations in the force of gravity act equally upon the standard weight and the mass being weighed. Therefore in measuring, the mass always has the same weight.

Since mass appears to remain the same when weighed on a balance, in chemical changes, and in changes of state brought about by heat, 19th-century scientists came to believe that matter is never created or destroyed. This theory is called the law of *conservation of matter*. A similar law held that energy is likewise conserved. Today we know that in certain circumstances mass and energy can be changed, one into the other. Then the two kinds of conservation are merged into one, the conservation of mass-energy. The conversions of mass and energy are important in changes which occur in the nuclei of atoms and when phenomena occur at speeds approaching that of light. They are not of measurable importance in everyday phenomena.

Electrical Forces in the Heart of Matter

MODERN views about the nature of matter arose when physicists discovered the electrical structure of atoms. The article on Atoms explains that every kind of atom has an inner core, or *nucleus*, which has positive electrical charge, and an outer portion consisting of from one to more than 90 particles called *electrons*. Each electron bears a negative electrical charge; and the electrical attraction between the positive nucleus and the negative electrons holds them together.

In everyday behavior of matter, however, the interactions between a nucleus and its electrons are not taken into account. These reactions depend upon interactions between different atoms; and these depend in turn upon interactions between electrons in the outer portions of the atoms involved.

These outer sections consist of one or more layers, or shells, each able to hold a certain number of electrons. In a few kinds of atoms, these shells are all filled; but in most, the outermost shell is incomplete. (In a few, two shells are incomplete.) Most common activities of atoms (and therefore matter) arise because atoms with incomplete shells tend to complete them in any way they can.

Spin Pairing of Electrons

This tendency of atoms to fill their shells exists because all electrons keep spinning; and electrons that spin in opposite ways tend to form pairs, just as the north and south poles of magnets attract each other. In atoms with complete shells, the electrons are all paired; but any incomplete shell will have one or more electrons which are not strongly paired within the atom. Such electrons will tend to form pairs with suitable electrons in some other atom or atoms.

This could not occur if the electrons were actually moving in orbits around their nuclei, as described in the article Atoms. But that description uses a simplified version of the motion as a basis for explaining the structure of atoms. Actually, electrons move more like bees in flight. They take countless different positions every second; and a pair of electrons drawn from two atoms could easily fly about both the atoms. But in such flight, electrons occupy certain positions much more than they do others; and these "average positions" correspond to the orbits described in the article Atoms. Many scientists emphasize this average nature of an electron orbit by calling it an *orbital.*

Forming Molecules by Sharing Electrons

The simplest example of electron pairing is afforded by hydrogen (H). This atom has one electron. When two atoms come close together and the electrons have opposite kinds of spin, the electrons form a pair and buzz back and forth from one atom to the other. This amounts to an attractive force which binds the two atoms together into one molecule (H_2).

Another simple example is that of chlorine (Cl). The outermost shell of a chlorine atom has seven electrons, or one more than three pairs. But the shell can hold eight electrons, or four pairs; and the unpaired electron in one chlorine atom can pair with a single electron having opposite spin in some other chlorine atom. Then by sharing the pair, each atom has an outer shell of eight; and the result is a molecule of chlorine (Cl_2).

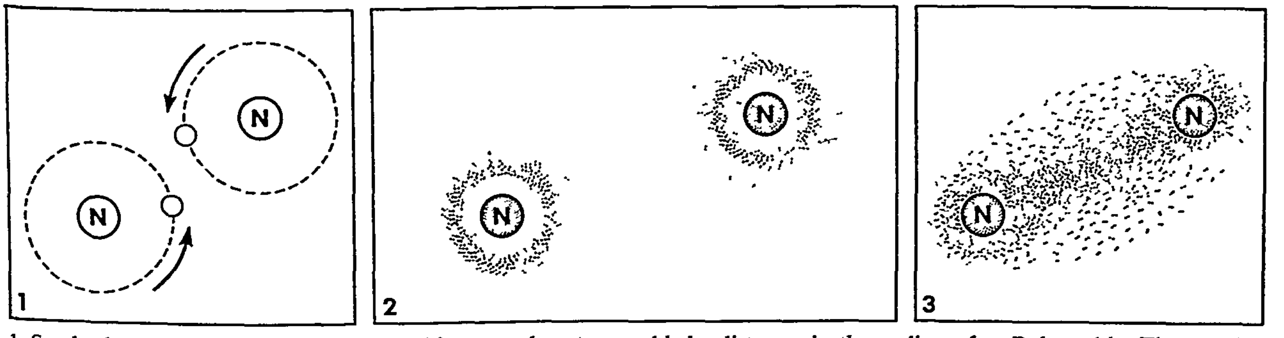
The forces between atoms which form molecules by electron sharing are called *covalent* (or *electron-pair*) bonds. They may also be called *homopolar* bonds, because they join atoms which have outer shells that can work together to form such bonds.

When atoms gain electrons outright above their normal number, as chlorine does, the shared electrons bring an excess of negative electric charge. Elements composed of such atoms are called *electronegative elements.* Atoms with less than four electrons in the outer shell can also share in excess electrons. But the outer-shell electrons are not held strongly by the nucleus, and the atoms can lose one or more electrons to superior forces on other atoms, leaving an unbalanced positive charge on the nucleus. Such elements are called *electropositive.*

How Atoms Form Ions

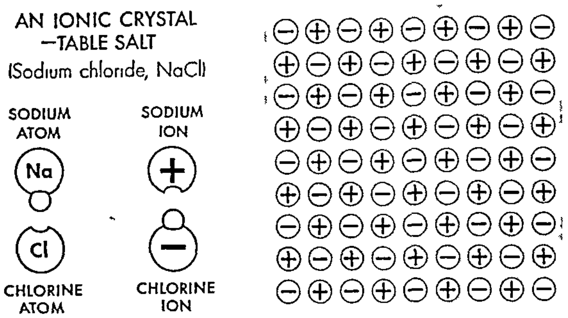
These transfers of electrons occur when strongly electronegative and electropositive elements come

HOW ELECTRONS MOVE IN A HYDROGEN MOLECULE



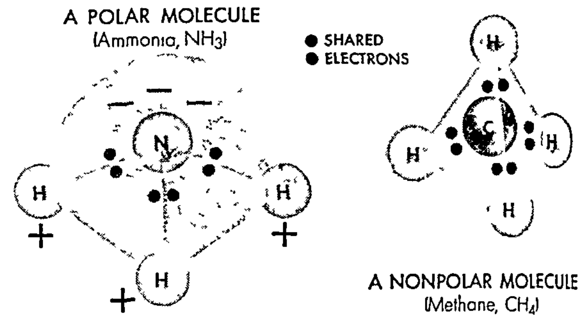
1. Single electrons are revolving in Bohr orbits around protons which form the nuclei (N) of two hydrogen atoms. 2 Modern physicists believe, however, that electrons fly about in space at various distances from the nucleus, depending upon the influences existing at each instant, and the most likely distance is the radius of a Bohr orbit. The number and distribution of dots show the electron movements and "most likely distances" for two hydrogen atoms 3. The atoms have formed a molecule by joining their electrons in a pair. The pair buzzes between the nuclei, as shown.

MOLECULES FORMED OF IONS AND OTHERS WITH SHARED ELECTRONS



Molecules of common table salt contain atoms of sodium and chlorine in equal amounts When these atoms come near each other under suitable conditions the chlorine steals one electron from the sodium. Thus chlorine atoms gain excess negative charge, and the sodium atoms are left with unbalanced positive charge. Such charged atoms are called *ions.*

In a solid mass of mixed sodium and chlorine ions, the charge on each ion extends beyond several of its neighbors. Therefore, the ions with negative charge are bound generally to several neighbors of its positive charge. Such a mass is called an *ionic crystal.*



In many molecules, the atoms *share* electrons instead of transferring them and forming ions; and in many molecules, the negative (electronic) charges and the positive (nuclear) charges are not evenly distributed. These unbalanced charges can interact between molecules to bind them. A molecule in this state is called a *polar compound.*

For example, ammonia (left, above) has shared electrons between a nitrogen atom (N) and each of three hydrogen atoms (H). Charges are unbalanced as shown. In contrast, the methane molecule (right, above) has evenly balanced charges and therefore is *nonpolar.*

together in suitable situations. For example, hydrogen has one electron which it can lose. A chlorine atom tends to gain a share in one excess electron. This tendency is strong enough, under suitable conditions, to take the lone electron away from a hydrogen atom. Thus each atom gains or loses an electron outright, instead of sharing a pair. Such atoms are said to be *ionized,* and the combination is called an *electrovalent, ionic,* or *polar* compound. (*See also* Ions and Ionization.)

When dissolved in liquids, ionic compounds fall apart (dissociate). The positive and negative ions wander about freely; and if a direct electric current is applied, they move in opposite directions (*see* Electrolysis; Solutions). In the solid state, ions tend to form masses called crystals.

Crystalline and Amorphous Solids

In crystalline solids, the ions are arranged in regular patterns called *lattices,* which satisfy all electrical attractions. The individual atoms in a crystal can be located accurately with X rays.

Glass is a different kind of solid. It starts as a melted mixture of sand (silicon dioxide) and oxides of sodium, calcium, or other elements. When it cools, some oxygen atoms have bonds with two silicon atoms, some with one sodium and one silicon, and so on. Hence no regular lattice of ions is formed. Many scientists call this kind of structure an *amorphous* (formless) solid. Others prefer to regard glass as a supercooled liquid.

In this type of solid some bonds are much easier to break than others. Therefore, when glass is heated it softens rather than melting like ice. In crystalline solids there is a sharp melting point, since the regular crystal structure requires that bonds break in all parts at the same temperature.

Polar Covalent Compounds and Cohesive Force

The water molecule has two atoms of hydrogen and one of oxygen (H_2O). Each hydrogen atom is held to the oxygen by a shared pair of electrons, or covalent bonds. Instead of being on opposite sides of the oxygen atom, both hydrogen atoms are on one side. Moreover, as the two pairs of electrons buzz about around the three nuclei, the oxygen atom keeps them a little more than its share of the time. Because of this lingering of the electronic negative charge, the water molecule is negative on the oxygen side and positive on the hydrogen side.

Molecules of this kind with charged ends are called *polar covalent.* (Uncharged molecules are called *nonpolar.*) The charged ends make water a good solvent for ionic compounds, since they help loosen the ions. They also exercise cohesive force in forming droplets and larger liquid masses. If enough heat energy is withdrawn, they bring water molecules together to form crystals of snow or ice (*see* Ice; Snow).

The weakest of all cohesive forces are found in nonpolar, covalent compounds, which have positive and negative charges evenly divided throughout the molecules. The slight forces that do exist (called *Van der Waals forces*) arise from the beelike flight of electrons. Although the flights "average out" to distribute the charge evenly, slight fluctuations occur. These result in a slight "spillover" of electrical energy which provides cohesive force between molecules, depending upon the kind and the temperature.

Atomic Structure and Energy

Atoms can absorb energy and radiate it again as radiant heat, light, and in other forms. As explained in the article on Energy, the nucleus of any atom is surrounded by many "energy levels" which the electrons within the atom can occupy. If an electron receives energy from outside, it jumps momentarily to a higher energy level, farther from the nucleus. But it snaps back quickly to its normal level, and radiates away the excess energy as infrared (radiant heat), some color of visible light, or an ultraviolet pulse (*see* Radiation).

Such actions occur most simply in the hydrogen atom, because it has only one electron. In atoms which have more than one electron, the responses to energy depend partly upon the way the electrons are arranged within the atom and partly upon which ones are free to receive and emit energy.

Electrons in complete shells are bound; but every electron in an incomplete shell can shift somewhat, because not all the available energy levels are occupied. What happens in any case will depend upon the fact that all forms of radiant energy which travel across space exist in "packets," or particles, of certain definite amounts (*see* Energy). The amount of energy in any particle depends upon the frequency of the vibrations and is found by multiplying this frequency by *Planck's constant.* Each packet is called a *photon,* or a *quantum,* of energy.

Whether an atom will absorb a certain quantum depends upon whether it has available an electron-jump to a vacant higher-energy level, which corresponds exactly to the amount of energy in the quantum. For example, vapor from intensely heated sodium absorbs a particular yellow light very effectively, because light of that color has just the energy needed to lift the outer electron of a gaseous sodium atom to the next allowed energy level. Sodium gas does not absorb other visible colors. The array of energy levels in each kind of atom explains why that atom gives off its own particular array of colors, thus making it possible to identify each element by using a spectroscope (*see* Spectrum and Spectroscope).

Metals and Electrical Conductivity

The electrons in metals can wander about freely, because in metals the outer electrons can be in any one of a large number of energy states. These are so close together that they overlap to form an energy "band." When a potential difference (voltage) is applied between the charged ends of a wire, these electrons migrate away from the negative toward the positive end of the wire. This shift of electrons constitutes an electric current. (*See* Electricity).

Although these outer electrons are called "free," they can only move about in the metal itself. They cannot leave the metal unless they are given a substantial amount of additional energy. In this respect they are much like the molecules in a liquid which can move freely in the liquid but are restrained from leaving the surface. The "free" electrons conduct heat as well as electricity; good electrical conductors are also good heat conductors.

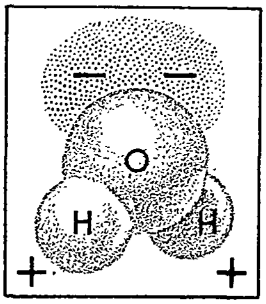
In the case of the nonconductors, such as glass, sulfur, and amber, almost all the electrons are tied firmly to an atom (or pair of atoms) in the material. The next higher energy levels for the electrons can be reached only if the electrons are given considerably more energy than is commonly used to maintain electric current.

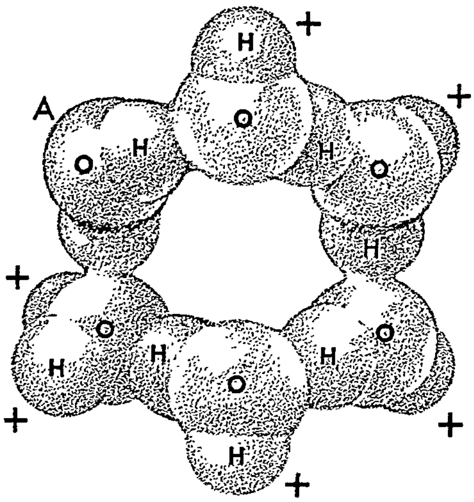
Nature of the Nucleus

All the interactions described so far arise from forces in which the electrons in atoms are involved. But the nucleus of an atom also has a structure and is

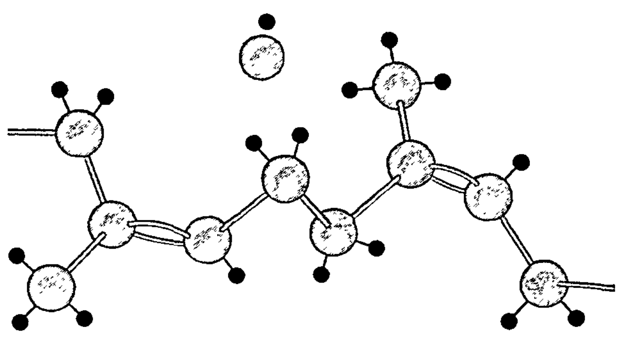
THE WATER MOLECULE AND HOW IT FORMS ICE

When one atom of oxygen (O) joins two of hydrogen (H) to form a molecule of water (right), they share some electrons more strongly than do the hydrogen atoms, throwing the electric forces of the molecule off balance. Each oxygen atom has excess negative charge, and the hydrogen atoms have unbalanced positive charge. Thus the molecule is a *polar compound.*



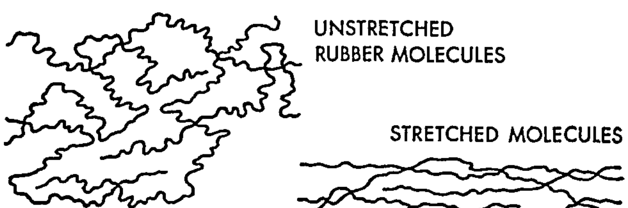


When water molecules lose sufficient heat energy, they move slowly enough to let opposite charges on various dipoles attract each other. Thus they begin forming a crystal of ice. In this diagram, molecule A has satisfied all unbalanced charges. The other molecules, however, still have some excess force free (marked +). These "left-over" forces can attract other dipoles, and bind the other molecules to the crystal.

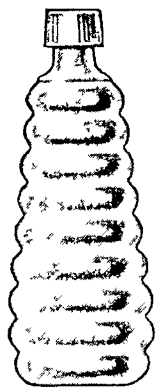


AN ATOMIC ARRANGEMENT
THAT MAKES RUBBER ELASTIC

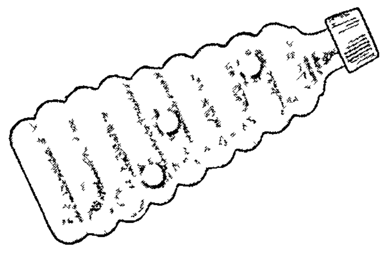
Two kinds of atoms are linked together in a kinky chain in this section of a rubber molecule. The complete molecule may contain 20,000 units in a chain. Interatomic forces hold the atoms in the kinky position, but they can yield enough to make the rubber elastic. When the tension is released, heat vibrations of the molecules restore the normal kinkiness.



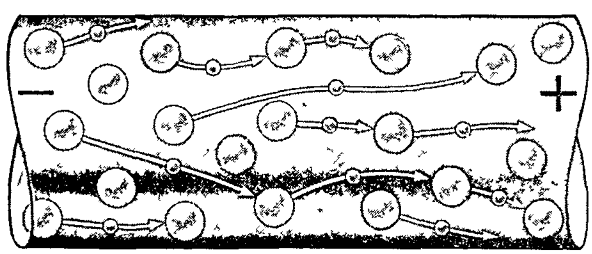
WHY METALS CONDUCT ELECTRICITY WELL



Different kinds of matter vary in response to electric charge and to other forces because of differences in the way electrons are arranged in energy levels within the atom. Why the energy levels are important can be explained by considering an olive oil bottle.



If the bottle of olive oil is full, the oil will not change position much, even if the bottle is tilted or moved. But if bubbles of air exist at various levels, the liquid can shift about at those levels because there is space for movement. Atoms of metals likewise have vacant energy levels, which act like the bubbles in the oil to permit the flow of electrons through the metal.



Here electric charges of opposite sign (negative and positive) have been applied to a piece of metal wire Electrons use "energy level holes" to shift freely from atom to atom in response to the charges. The moving electrons constitute electric current.

the direct source of many phenomena such as radiation of high-energy particles and electromagnetic pulses. Reactions between the particles which make up the nucleus are especially important in understanding the transmutation of elements and the release of atomic energy.

Nuclei are built up out of positively charged particles called *protons* and electrically neutral particles known as *neutrons*. Both kinds of particles have about the same mass, roughly, 1,840 times the mass of an electron. The nucleus (nuclear particles) is packed together in a very tiny volume. For most atoms this is only about one trillionth of their entire volume. The attractive forces between the particles in the nucleus are very great. On the average it takes several million times as much energy to pull one of the particles out of its nucleus as it does to remove an electron from most atoms.

Since like charges repel one another, there is an *electrical* repulsion between every pair of protons in a nucleus. There is a much greater *nuclear* attractive force of *nonelectrical* nature between two protons which are sufficiently close together. This attractive force decreases very rapidly as the distance between the protons is increased, while the electrostatic repulsive force decreases much more slowly. The electrical repulsion between protons is the main reason that nuclei with more than 82 (or possibly 83) protons are never stable.

There is good reason to believe that within a nucleus protons may give their charges to neutrons and later get them back. The forces which come about as the result of the charges moving back and forth are called "exchange forces."

Nuclear Radiations and Energy Levels

Various particles within a nucleus seem to move like a swarm of bees, much as electrons do. They also maintain certain "average positions," with corresponding separate energy levels. If they are struck by a flying particle with sufficient energy or by a sufficiently high-frequency, high-energy photon, some of the particles are excited to higher levels.

As they fall back to normal levels, they give off radiation of various kinds. One kind is an electromagnetic pulse called a *gamma ray*. Other radiations consist of particles of matter; loss of one or more particles changes (transmutes).the nucleus and therefore the atom. The expelled particles may be protons, neutrons, or a group of two protons and two neutrons called an *alpha ray*.

The nuclei of radioactive elements also emit electrons (called *beta rays*) and positrons. Many tests indicate, however, that these particles do not exist within the nuclei. They seem to be created at the instant they are expelled, while one of the neutrons in the nucleus is changed to a proton. In the expulsion, the electron is accompanied by a *neutrino*, a particle without electrical charge and with a very small or zero mass (*see* Radiation; Radioactivity.)

Other Particles in Nature

There are several particles which have a mass between that of the electron and that of the proton. These particles are called *mesons*. Mesons were first observed in cosmic ray studies. (Cosmic rays are tremendously high-energy particles which reach the earth from outer space. Their origin is not fully understood.) Now mesons can be produced in the laboratory with the aid of a high-energy cyclotron.

The first mesons which were discovered are called *mu mesons* or *muons*. They weigh about 215 times as much as electrons. Other mesons weigh 280 times as much. These are called *pi mesons* or *pions*. Each kind may have a positive or negative charge.

Both pions and muons exist for only a few millionths of a second. Negative pions are strongly attracted by positive nuclei and are captured by them. A positive pion may decay into a positive muon and a neutrino. The muon may then turn into two neutrinos and a positron. In addition to positive and negative pions and muons there is evidence that neutral mesons and several kinds of heavier mesons exist.

There is much reason to believe that mesons play an important role in nuclear forces, but the exact function of mesons in the theory of the nucleus is not yet understood.

This young draftsman accepts criticism in good spirit because he has a realistic concept of his own abilities. He is as well adjusted in his social life and in his home as he is in business.

MATURITY—

The Test of Personality

MATURITY. The mature person is fitted for happy and effective living. In his business, in his social life, and in his home he makes good adjustments. He does not owe his fortunate personality to some inborn physical or mental strength. He is mature because he has had the right training in childhood and because he wants to behave in a mature way.

Each group and each nation has its own standards of mature behavior, and individuals are judged by those standards. Most primitive peoples train their children for adult life. Most civilized nations also emphasize such training in the home and in the school. As a result, these young people are ready to assume the duties as well as the privileges of adulthood.

American parents, by contrast, emphasize a happy, carefree childhood and hope that their children will somehow be able to shoulder adult burdens when they reach adult age. The rising rates of divorce and of juvenile delinquency challenge this hope. From business and industry also come reports of poor adjustments made by young workers.

What Is Maturity?

Criteria for maturity have been established in seven different areas—physical, intellectual, emotional, social, psychosexual, moral, and religious. These criteria are based on observations of people and not on armchair speculation. The mature person is mature in *all* these areas. Suppose, for example, that a man shows the same unreasonable jealousy of women that he showed in his high-school days or has temper tantrums like those of his preschool days. He may be mature in all areas except the emotional; yet he cannot expect to get along well in his business, social, or home life.

Although there is no such thing as *partial* maturity, no one is equally mature in all areas. Even the most mature person will at times go back to adolescent or even childish behavior. Most of the time, however, his behavior is mature. He is careful to display immature behavior at times when he will not be seen by those whose esteem he is especially eager to win.

Physical Maturity

Different parts of the body reach their mature size and level of functioning at different ages (*see* Child Development). The secondary sex characteristics, which differentiate the adult male from the adult female body, appear several years before the sex organs are mature either in size or function.

Changes in interests and behavior accompany sexual maturity, but these changes do not automatically result in a mature level of behavior. This comes only with training and a desire on the adolescent's part to "act his age." (*See also* Adolescence.)

Intellectual Maturity

For persons of average intelligence, mental development reaches its mature level between the ages of 13 and 15. For persons of superior intelligence, the mature level is not reached until some time between the ages of 16 and 25. Persons of inferior intelligence reach the mature level early, some before the age of nine. Intellectual maturity is judged by

the use a person makes of the intelligence he has, not by the degree of his mental development.

With increasing age, there should come a change of interests. The intellectually immature person is interested mainly in himself, his problems, and in things that normally interest people much younger than he. His interests are changeable like a child's, so that one never knows from day to day what they are. The mature person is interested in other people and in adult activities and studies. Furthermore, his interests remain stable over a period of time.

The intellectually mature person is not easily swayed by what others say and do. On the other hand, he is not rigid in his thinking and he changes his attitudes when it becomes apparent that they are narrow, biased, or incorrect. Immature attitudes stem from feelings of insecurity.

Superstitions are unfounded beliefs passed down from one generation to another. The mature person is skeptical of any statement founded on no more solid basis than that it has always been believed.

Realistic self-appraisal also characterizes the intellectually mature person. He recognizes his shortcomings and tries to overcome them but does not apologize for them. He also knows his own abilities and tries to put them to the best possible use. The intellectually immature person, like the child, cannot appraise himself realistically. He sees himself as he would like to be or as his parents, teachers, and friends think of him. To hide his shortcomings he uses escape mechanisms, such as daydreaming, imaginary invalidism, or projection of the blame on others.

INTELLECTUAL MATURITY
This woman is not easily influenced by what others say, but she is ready to change her attitude when convinced it is wrong.

Emotional Maturity

Immaturity is more apparent in the emotions than in any other area of behavior. Children can be trained to harness their emotional energy and put it to good use. It is a mistaken belief that such training means repression (*see* Child Development).

The emotionally mature person does not give violent expression to fear, anger, jealousy, or even happiness. He expresses his emotions in *partial responses.* He substitutes a smile for loud laughter, a frown for fighting, and a look of concern for childish horror. He is capable of bearing emotional tension and great stress. He waits for a suitable time and place to express what he feels. In private he may give vent to some of the emotions he controlled in public, but this is usually

EMOTIONAL MATURITY AND IMMATURITY
This young girl has learned to give vent to her emotions when she is alone instead of breaking down and weeping in public.

The young man has not yet learned to control his emotions and swings from one mood to another. Now he is sulking.

unnecessary because he is not easily stirred up. He asks himself: Is this worth getting upset about? Did he mean what he said as it sounded, or am I reading meanings into it? Does her interest in someone else really mean lack of interest in me? By this critical assessment he discovers that a situation he was tempted to respond to emotionally is not worth the effort.

Adolescents and the immature have a tendency to swing from one mood to another for little or no reason. The emotionally mature person is free from moodiness. He is also free from sentimentality, although he is not lacking in love, patriotism, or loyalty to family and friends. He simply does not allow his sentiments to sweep him off his feet.

SOCIAL MATURITY
The socially mature person can be happy when alone. That is the time to enjoy a good book or to engage in one's hobby.

Social Maturity

A socially mature person gets along well with all types of people in all types of situations. He does not necessarily like or respect all people, but he is tolerant and understanding and does not intentionally hurt anyone's feelings. Nor does he discriminate against people because of their race, religion, national origin, or their social and economic status.

The child and the adolescent often act as if they own their friends. The socially mature person does not demand the exclusive attention of his friends, nor does he show jealousy of their other friendships. His affection, however, is strong and lasting because he does not become completely disillusioned when he sees a flaw in a friend's character. While he may prefer companionship to solitude, he can amuse himself and be happy when alone.

The socially mature person is emancipated, or psychologically weaned, from his childhood home. Even though he may still live with his parents, he makes his own decisions. The socially immature person cannot live happily either with his family or away from them. He finds fault with everyone and everything in his home and rebels against any suggestions his family makes. He craves attention and indulges in attention-getting behavior, such as complaining about his poor health and feeling sorry for himself. He is likely to seek the company of older people who play the role of parent-substitutes and may show exaggerated affection for an older person of the same sex.

The person who conforms slavishly to group standards, through fear of social disapproval, is socially immature. So also is the unconventional extremist who seeks to gain attention by being obviously different. The socially mature person accepts the patterns of his group. He does not do this through fear of group opinion or even because he necessarily approves of the patterns. Rather, he realizes that each individual must be willing to merge his personal interests into the approved patterns.

In a democracy, government is by the people. A mature citizen does not, therefore, limit his part in the government to paying taxes, voting, and obeying the laws. He recognizes that everyone has responsibilities to his town or city, his state, and his nation. He accepts appointed or elected offices, fights for his country in time of need, and takes positive steps to bring about reforms when he sees they are needed. (*See also* Citizenship.)

PSYCHOSEXUAL MATURITY
The newly born kittens are giving this boy his first lesson in sex education. He is learning in a natural way from his mother, who has a healthy, mature attitude.

MORAL IMMATURITY
These boys think they are smart to "get away" with cheating. They reject the moral code of the group to which they belong.

Psychosexual Maturity

Psychosexual maturity relates to attitudes and behavior in relation to sex and to members of the opposite sex. Whether a person is psychosexually mature or immature depends largely upon the type of sex education he has had and upon the attitudes of his family and friends. The immature person's attitudes may change, however, if his experiences with the opposite sex are favorable. The mature person regards sex as a normal function of life and is neither frightened nor shocked by it. The immature person is likely to be prudish or to show an unusual interest in sex.

In childhood, antagonism between the sexes is common. Boys feel superior to girls and treat them accordingly. Girls retaliate by calling boys "crude" and "rude" and by scorning boys' activities, yet secretly wishing they could be boys. When these attitudes persist, the person is regarded as psychosexuallyimmature. The mature person accepts persons of the opposite sex as equals and is able to work and play comfortably with members of both sexes.

The traditional role for a woman is that of mother and homemaker. The man's role is that of breadwinner. Many women today find it difficult to accept their traditional role, particularly if they have had some success before marriage in business or in a profession. Their rebellion is called the "masculine protest." It may take the form of trying to dominate men, the family, or community affairs and of minimizing men's achievements. The "masculine protest" is an indication of psychosexual immaturity.

Moral Maturity

A morally mature person realizes that no one can be a law unto himself. He therefore accepts the moral code of the group to which he belongs even though he may not agree with it. He will not be influenced to do things he knows are wrong when he is with people who have lower standards. His moral code is stable.

A child may look on a person who has the boldness to do wrong as a hero. The adolescent is likely to regard a lawbreaker as wicked. Immature adults may react in either a childish or an adolescent way to wrong behavior. The morally mature person tries to understand the motives of the lawbreaker. If he is in a position that requires him to mete out punishment, he will do so reluctantly.

Religious Maturity

The mature person will accept the beliefs of his religion and fit them into his other beliefs. He will make use of them in his daily life. He will not regard prayer as a means of winning material possessions or of getting out of a predicament. Nor will he reject prayer as useless because many of his childhood requests went unanswered. Instead, he will accept prayer as something to help him and will pray when he feels the need for it.

The religiously mature person will not attend church because of fear or force of habit but because he receives some personal benefit from the service. He will take an active part in both the religious and the semireligious affairs of his church because he regards such participation as one of his duties as a good citizen.

Religious tolerance is one of the outstanding qualities of the person who is truly mature. He realizes that other faiths mean as much to other people as his own faith means to him.

RELIGIOUS MATURITY
Mature people do not go to church from force of habit or because it is "the thing to do." They go because they receive personal benefit from the service.

MAURITIUS. A little oval emerald, fringed with coral and set in the sea—such is the tropical British island colony of Mauritius, in the Indian Ocean about 545 miles east of Madagascar. Its picturesque beauty, with mountains more than 2,700 feet high, is well known from the description given in Bernardin de Saint Pierre's classic, 'Paul and Virginia'.

Much of this island is still green with bamboo thickets and forests of coconut palm and other tropical trees, although large areas have been stripped to make way for numerous sugar plantations. Sugar is the chief export, and to it the island owes its prosperity. Fruits, dates, coconuts, and other tropical crops are grown, for agriculture engages a majority of the inhabitants. Mauritius is one of the most densely populated regions in the world, owing to importation of Hindu Coolies to work in the sugar fields. In addition there are Chinese, Malays, Negroes, and about 4,000 whites. Most of the whites are descendants of early French colonists.

Mauritius was discovered about 1505 by the Portuguese, who soon abandoned it. It was occupied in 1598 by the Dutch, who gave it its present name after Count Maurice of Nassau. The French ruled it after the Dutch left in 1710. They called it Île de France. The English occupied it in 1810.

Mauritius was once the home of the dodo—a pigeon as large as a turkey—and of a large land tortoise and a crested parrot. They are now extinct (*see* Dodo). Hurricanes often sweep over the island. Area, about 720 square miles; population (1944 census), 419,185. The capital is Port Louis (57,466).

MAXWELL, JAMES CLERK (1831–1879). Scientists of the Royal Society of Edinburgh were surprised to find a 14-year-old lad at their meeting in 1845. They may have smiled at his eager interest in science and wondered how long it would last. Today millions of people enjoy radio and television programs brought to them on radio waves because James Clerk Maxwell spent his life seeking answers to the mysteries of the physical universe.

Maxwell worked out the mathematical equations that showed the action of electromagnetic waves in space. It remained for later experimenters to demonstrate their existence and for modern inventors to put them to practical use (*see* Radio).

James was born at Edinburgh, Scotland, Nov. 13, 1831, of well-to-do parents. Their family name was Clerk. "Maxwell" was added later. The two names are sometimes hyphenated. James's mother died when he was eight, and the lonely lad had time to study and to ponder the wonders in the world about him. He submitted a mathematical paper to the Royal Society when he was a 15-year-old student at Edinburgh Academy. He entered the University of Edinburgh the next year and went on to Cambridge in 1850. There he won honors and prizes in mathematics and was placed on the staff of lecturers at Trinity College.

In 1858, while he was professor of natural philosophy at Marischal College, Aberdeen, he married Katherine Mary Dewar, daughter of the principal. Two years later he joined the faculty of King's College, London. He retired in 1865 to carry on his experimental work but was called to the new professorship of experimental physics at Cambridge in 1871. There he planned the famous Cavendish laboratory. Maxwell was an excellent teacher and one of the great mathematical geniuses of his time. Hardworking in the classroom and laboratory, he was a friendly, genial man in social life.

The range of his experiments and contributions to science was broad. He made significant studies on the theory of color and on color blindness. He wrote a prize-winning essay 'On the Stability of Motion of Saturn's Rings'. He contributed to the development of the kinetic theory of gases.

His greatest work dealt with electricity and magnetism. He studied the experiments and theories of Michael Faraday with "something like religious reverence" (*see* Faraday). In trying to explain the phenomena discovered by Faraday, he reasoned that electromagnetism moved through space in waves. He calculated their velocity and, finding that their speed was the same as that of light, assumed that light waves are electromagnetic in nature.

At the time there was no evidence of comparable waves which could be sent or detected over any considerable distance, and Maxwell died before this theory was put to any test. In 1888, however, Heinrich Hertz performed experiments based on Maxwell's theories and demonstrated that an electric disturbance is transmitted through space in form of waves (*see* Radiation). Today electromagnetic waves are known to cover a wide range of radiation, from infrared to gamma rays.

Maxwell expressed all the fundamental laws of light, electricity, and magnetism in a few mathematical equations, commonly called the "Maxwell field equations". These equations were long considered a "fundamental law" of the universe, like Newton's laws of motion and gravitation. They still hold good for phenomena which do not require use of the quantum theory, wave mechanics, and relativity (*see* Energy; Matter; Relativity).

MAY. The fifth month of our year, some scholars think, takes its name from the goddess Maia, mother of Hermes. She was identified by the Romans with their ancient goddess of spring and honored in a festival on the first day of the month (May Day).

In old England on May Day, people used to go "a-maying" at an early hour "to fetch the flowers fresh." The fairest maid of the village was crowned with a wreath as queen of the May. Every village had a Maypole on the green. The villagers twined it with flowers and ribbons and danced around it, a practice strongly denounced by the Puritans.

May Day was selected by the Second International in 1889 as International Labor Day. It is observed with parades and speeches by radical organizations in nearly every industrial country. In Russia it is an official holiday (*see* Russia).

MAY APPLE. In woods and pastures in early spring, May apple plants raise their leaves like pale-green umbrellas. Below two spreading, deeply lobed leaves, each with a span of perhaps a foot, a single waxy-white flower nods in the fork of the stem. (For picture in color, *see* Flowers.)

The "apple," also called a "wild lemon," ripens in July. It is an egg-shaped yellow fruit from one to two inches long. It is actually an edible berry, with a peculiar sweet and sour flavor.

In the United States the May apple is often called "mandrake." The true mandrake, however, is a totally different plant, native to the south of Europe and Oriental countries (*see* Mandrake).

The May apple is a perennial herb which is common in the northeastern part of the United States. Its scientific name is *Podophyllum peltatum*. It belongs to the barberry family (*Berberidaceae*). The smooth leaves are from 9 to 12 inches wide; the fruit is one-celled and many-seeded.

CIVILIZATION *in the* JUNGLES *of* YUCATÁN

MAYAS (*ma'yaz* or *mī'az*). Ruins of ancient cities rise in Honduras, Guatemala, southern Mexico, and Yucatán. Their richly sculptured stones bear evidence of one of the most advanced American Indian civilizations, that of the Mayas. It flourished from 700 to 1,500 years ago. The Mayas made an accurate calendar based on the sun's movements. They created a number system comparable to the decimal system. They invented a method of writing.

The Mayas had built their first cities by A.D. 320. Their civilization had reached a climax, declined, revived, and declined again before Cortez sailed around Yucatán in 1519 (*see* Cortez). The Spanish conquest of the peninsula in 1527–46 completed the downfall of the Mayan culture.

The Mayas survived the death of their culture. There are almost 2 million Mayan Indians today, chiefly in the northern part of Yucatán and in Guatemala. They live much as the common people among their ancestors did.

Corn Farming the Basis of Mayan Life

The average Maya has always been a corn farmer. Today he lives in a thatched house in a village three or four miles from his cornfield. In ancient times he lived in a similar thatched house on the outskirts of a great city. Beyond the city and all around it lay the cornfields.

At the top is a picture in stone of a thatched house. It is part of the sculptured decoration on an ancient building at Uxmal, Yucatán. At the bottom is an identical thatched house, the home of a present-day Mayan farmer. The women in this picture wear traditional Mayan dress but carry their corn in factory-made granite basins. Such contrasts are typical.

The Mayan way of farming has not changed. Primitive though it would seem to a North American farmer, it is the only method that succeeds in the land of the Mayas. This land—which extends from the northern shore of Yucatán south to the Pacific—has only two seasons, a rainy and a dry one. Jungle or rain forest covers most of the region and grows up again almost as fast as it can be cleared away. The soil, a thin covering on limestone rock, cannot be plowed.

When the Maya makes a new cornfield, he begins to clear it at the height of the rainy season. He cuts down the bush and small trees and "rings" larger trees with his ax so that they will die. He lets the cut vegetation dry out under the hot sun of the dry season. Then he burns it. After the first showers of the rainy season he plants his corn, using a pointed stick to make holes for the seed. This stick today has an iron point. Before the Mayas understood the use of iron, they hardened the point with fire.

Weeds—the reappearing jungle and forest growth—are the Mayan farmer's mortal enemies. The present-day Maya cuts the weeds. They grow back so persistently that after a field has been planted twice it is easier to burn off a new one than to weed the old one. In ancient times the farmer pulled up the weeds by the roots and could use the same field for several years. Eventually, however, thick grass took it over. Then corn would not grow and he had to find a new field.

How Corn Farming Produced a Culture

A Mayan farmer can raise enough corn for his family by working 50 to 75 days out of the year. Thus he has from 290 to 315 days when he need not work at his basic, essential occupation.

In the old Mayan civilization the upper classes made use of this surplus time. Farmers had to raise corn and other crops for the nobility, the priests, and the head of the state. They had to contribute labor toward the building of the cities. The ancient Mayas had no draft animals and no wheeled carts. Only the labor of countless corn farmers made the great stone buildings possible.

The corn farmers' labor also gave freedom from manual work to the nobility and the priests. These people, therefore, had time to plan, direct, study, and invent.

The type of farming that made Mayan culture possible probably also contributed to its downfall. Food must have become scarce as the cornfields were planted farther and farther away from the city. Famines may have occurred. Eventually the city had to move, and the long exhausting process of building had to begin again.

THIS IS CHAC-MOOL

Many stone figures like this one have been found at Chichen Itzá. The Mayas call them Chac-Mool ("Red Claw"). No one knows what purpose they served. In the background is a feathered-serpent column.

Corn at Every Meal

At least three fourths of all the Maya's food is corn in some form. The proportion may have been even higher in ancient times. The modern Maya has pigs, chickens, turkeys, and cattle to supply meat, while his ancestors had only turkeys and game. So important was corn to the ancient Maya that he believed his creator god had made the first man out of corn.

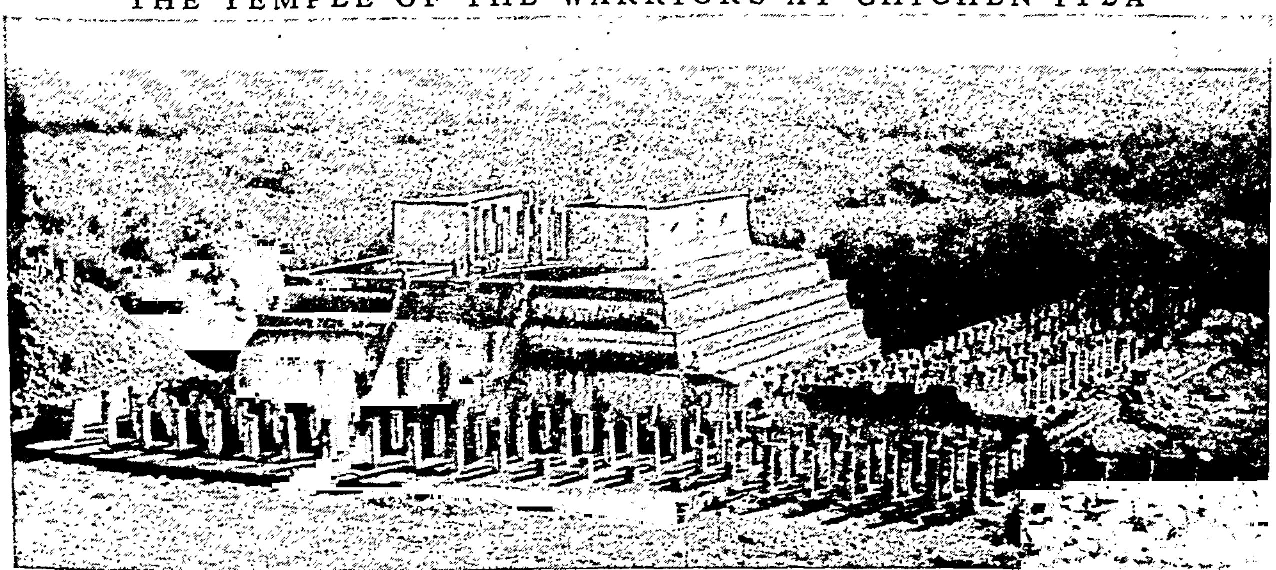
Grinding the corn has always been a duty of the Mayan wife. Until recently she ground it between two stones. Today she grinds it at home in a hand-turned metal grinder or carries it to a village mill which is power driven.

The staple article of diet, eaten at every meal, is the tortilla, a kind of corn-meal pancake (*see* Food, section "What People Eat in Other Lands"). In addition there are two nourishing drinks made of corn-meal dough and water: *atole*, a hot drink; and *pozole*, a cold one. The Mayas also have beans, squash, various other vegetables and fruits, and chocolate.

Rise and Fall of the Ancient Mayas

The history of the ancient Mayas has two periods: the Old Empire (about 320 to 987) and the New Empire

THE TEMPLE OF THE WARRIORS AT CHICHEN ITZÁ



The pyramid shown here encloses an earlier structure called the Temple of Chac-Mool. The temple on top of the pyramid is known as the Temple of the Warriors because nearby columns carry reliefs of men in battle dress. The columns are part of the Court of the Thousand Columns, a plaza surrounded by colonnades. The Chac-Mool and feathered-serpent column shown in the picture at the top of this page stand at the entrance to the Temple of the Warriors.

(987 to the Spanish conquest). The term empire indicates a period of culture, not a form of government; the Mayan cities were independent city-states.

Cities of the Old Empire included Tikal (probably the earliest), Uaxactún, Copán, Piedras Negras, Palenque, and Quirigua, all in the southern half of the Mayan territory. (For maps, *see* Central America; Yucatán.) The Mayas accomplished their feats of learning, built many of their finest buildings, and created their most remarkable sculptures during the Old Empire. No one knows for sure why this civilization declined, but exhaustion of the cornfields is thought to have been a cause.

Migrations of Indians from Central Mexico into Mayan territory occurred in the 10th century. Kukulcan, a legendary white man whom the Aztecs called Quetzalcoatl, settled at Chichen Itzá and also founded Mayapan in 987. Other cities of the New Empire were Uxmal and Kabah. All were in northern Yucatán. (*See also* Mexico, subhead "History of Mexico.")

The migrations renewed the Mayan civilization and brought changes. The people became more warlike. They practiced human sacrifice to Kukulcan, worshiped as a feathered-serpent god, and to earlier Mayan gods. Among events which led to the decline of the New Empire were wars between the cities, a disastrous hurricane, crop pests, and plague.

Architecture and Other Arts

The Mayas built their cities around a ceremonial and governmental center. The chief structure was usually a temple on top of a pyramid. In addition there might be palaces for rulers and priests, a round tower that served as an observatory, a ball court where men played a game something like basketball, a colonnaded market place, and many monuments bearing dated inscriptions. (For pictures, *see* Indians, section "Indians of Other Times and Places"; Exploration.)

The Mayas constructed their pyramids and building walls of rubble and mortar, faced them with stone, and covered them with lime plaster. They used the false arch, built by placing stones horizontally, staircase fashion, on the two sides of an opening so that they met at the top. Supporting walls had to be thick, and interiors, therefore, were narrow. Decoration consisted of molded stucco, sculptured reliefs, and wall paintings. Geometric designs, grotesque masks and figures of gods, and formalized representations of men and animals were common. At Old Empire centers, amazingly realistic sculptures have been found

The Mayas created beautiful painted pottery and fine cotton textiles. Not much is known of their basketry. They did little work in metals.

Religion and Learning

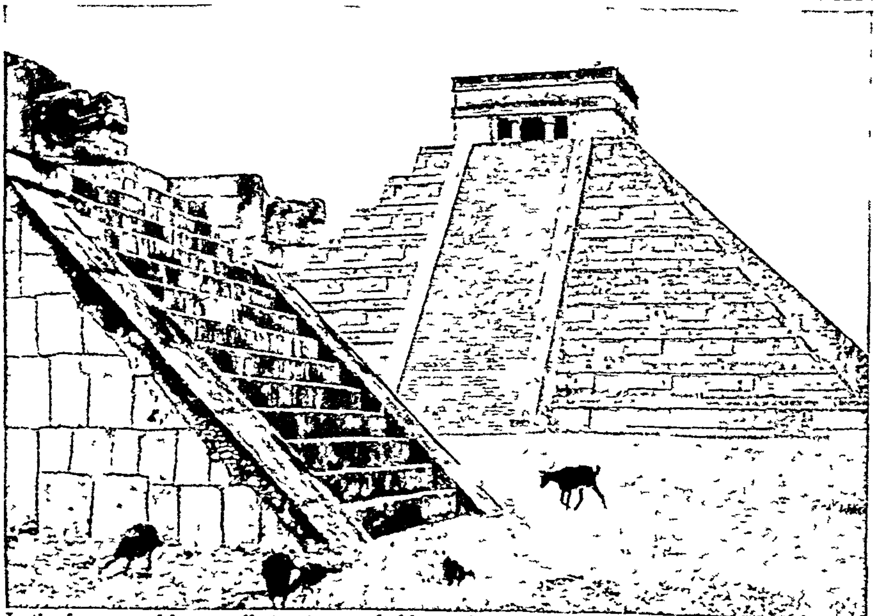
The importance of corn in the lives of the Mayas had far-reaching results in their religion and culture. The chief gods other than Kukulcan were rain gods (Chacs), wind gods (Iks), a sky god (Itzamna) who ruled the sun and moon, and a corn god. The people prayed to these gods for success at all stages of their corn farming. Priests studied the passing seasons to determine favorable days for burning the fields and planting seed. In doing so they observed the movements of the sun and moon. Thus they learned the exact length of the solar year and devised a calendar more accurate than any except the Gregorian.

Having a calendar, the Mayas invented a numbering system to record the passing years. Their method involved the idea of zero. It was a positional method, like the decimal system, but 20 was the unit of progression instead of 10. The symbols were dot-and-bar combinations and hieroglyphs.

Eventually scholars developed a system of hieroglyphic writing. This was of the same type (ideographic) as ancient Egyptian writing but at a more primitive stage. With it the priests created beautiful painted books on paper made of bark pulp. The Spanish invaders, believing the books would foster pagan beliefs, burned most of them.

The ancient Mayas' feats of learning, even more than their artistic achievements, give to their culture its reputation as the most advanced of all American Indian civilizations.

WHERE NEW EMPIRE MAYAS WORSHIPED KUKULCAN

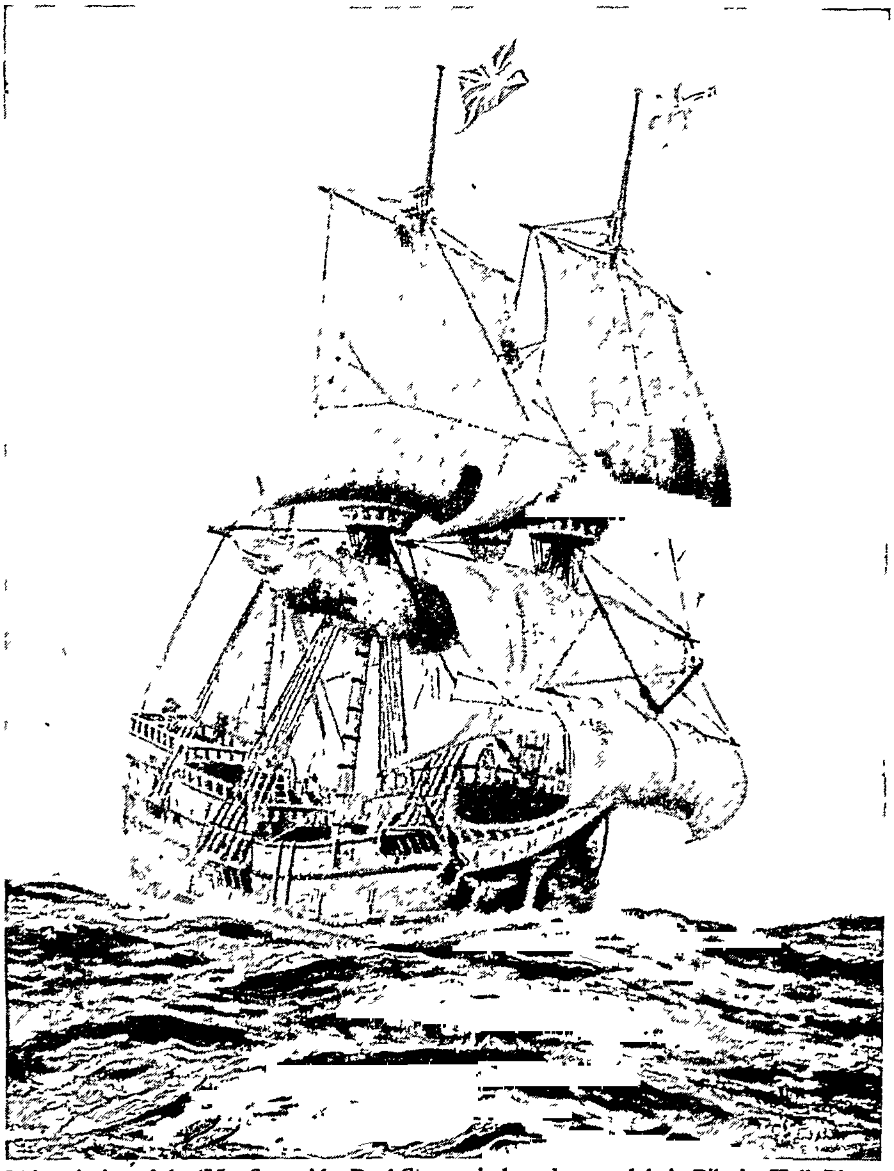


In the foreground is a small structure probably used as a platform for ceremonial dances. In the background towers "El Castillo." This is actually a temple to Kukulcan erected on top of a pyramid 100 feet high. Inside the pyramid, in an earlier shrine, is a stone jaguar painted red, with inlaid spots of bright-green jade. This picture was taken at Chichen Itzá.

The 'MAYFLOWER'S' VOYAGE *for Religious* FREEDOM

'MAYFLOWER'. A storm-tossed, 65-day voyage across the wintry Atlantic in 1620 carried the small, slow merchant vessel *Mayflower* into an honored place in American history. Crowded on board were the men, women, and children who founded Plymouth, the first permanent colony in America settled by families. These people, now called the Pilgrims or Pilgrim Fathers, were the first colonists who came to the New World to gain religious liberty. They were the first to draw up a written agreement providing for a democratic government. This historic document, signed in the ship's cabin, is now known as the Mayflower Compact.

The settlers came from England where King James I did not permit freedom of religion. Everyone was expected to worship according to the teachings of the official state denomination, the Church of England. Some groups of people objected to certain of its practices. The Puritans set out to purify the state church (*see* Puritans). The Separatists wished to have a separate denomination.



This painting of the 'Mayflower' by Paul Strayer is based on models in Pilgrim Hall, Plymouth, Mass., and other museums. The stubby, broad-beamed ship was built for generous cargo space rather than speed. It averaged under two miles an hour en route to America.

Separatists Migrate for Religious Liberty

Leaders among the Pilgrim Fathers had been members of a little congregation of Separatists. They had gathered to worship in secret at William Brewster's manor house in the village of Scrooby in Nottinghamshire. Spied upon, found out, and persecuted, they determined to seek a home where they could worship as they chose. They escaped to Holland in 1608. In Leyden these English farming folk founded a church and a religious community. Even with their religious freedom they did not feel at home in the Dutch industrial and commercial city. Many had a hard struggle to earn a living in unfamiliar work. Parents worried for fear their children would grow up as Dutchmen. After a long discussion it was decided to go into the wilds of the New World where they might keep their native language and customs and also have freedom of worship.

Arranging to Settle in America

Three years were spent making necessary arrangements. They obtained a patent from the Virginia Company of London to settle in the territory then called Virginia (*see* American Colonies). Lacking money to buy supplies and pay expenses, they contracted with a group of merchants to finance them. In return they had to promise to work seven years and share everything they produced with the merchants.

The group from Leyden sailed to England in a small ship, the *Speedwell*, which they planned to use for commercial fishing in America. On the *Mayflower* in Southampton harbor, there were other English Separatists and a group of "strangers" recruited by the merchants. Twice they started together for the New World only to be forced to return to England because the *Speedwell* was leaking. Finally they abandoned her. Some of her passengers stayed behind and the rest crowded onto the *Mayflower*. The "strangers," including the servants, outnumbered the "saints," or Separatists. The "saints" remained in control.

It was September 16, nearing the season of westerly gales and fall equinoctial storms, when the ship finally set sail from Plymouth, England. Captain Christopher Jones was in command.

Crowded Quarters on the 'Mayflower'

What was the historic ship like? No authentic plans or dimensions are known to exist. But naval architects have made models based on designs of other merchant vessels of the day. She was a three-masted sailing vessel of 180 tons. Her length was approximately 100 feet and her greatest width was 26 feet. Her stern rose 27 feet above the water when loaded. Two decks ran the length of the ship. The forecastle rose from the main deck in the bow. It contained quarters for the crew of 30 and the galley where the crew's food was prepared. At the stern the poop house and poop deck sat atop the half deck. Here were two fair-sized cabins which were normally used as quarters for the ship's officers.

Historians have wondered how more than a hundred passengers found sleeping space. One writer guessed that if the officers gave up most of their cabin space, perhaps 54 parents and children could sleep in tiers of double bunks there. The single men and boys could bed down on pallets or hammocks between decks. Their goods and supplies were stored in the hold.

Nobody had privacy. There were no sanitary facilities, and fresh water was too scarce to use for washing. Seasickness plagued the travelers. The stench in the crowded quarters must have been offensive.

Cold food was the chief fare of the passengers—hard biscuit, cheese, and salted beef or fish. An occasional hot dish could be cooked over an open charcoal fire in a box of sand. Without fresh provisions, many passengers contracted scurvy in the 65-day voyage. They suffered from exposure to bitter winds and icy waters. When storms tossed the ship, the caulking worked out of the upper seams letting in the freez-

THE LIST OF MAYFLOWER PILGRIMS

Americans take pride in descent from the Pilgrims, though all were humble folk. Not one was entitled to a coat of arms or had completed a university course. A General Society of Mayflower Descendants was formed in 1879. The actual number of passengers depends upon whether one counts William Butten, who died at sea; Oceanus Hopkins, born at sea; and Peregriene White, born on the ship after it reached Plymouth harbor. Governor Bradford's famous history, 'Of Plimoth Plantation', contains the following list:

The names of those which came over first, in the year 1620, and were by the blessing of God the first beginers and (in a sort) the foundation of all the Plantations and Colonies in New-England; and their families.

Mr. John Carver; Kathrine, his wife; Desire Minter; and 2. man-servants, John Howland, Roger Wilder; William Latham, a boy; and a maid servant, and a child that was put to him, called Jasper More.

Mr. William Brewster; Mary, his wife; with 2. sons, whose names were Love and Wrasling; and a boy was put to him called Richard More; and another of his brothers. The rest of his children were left behind, and came over afterwards.

Mr. Edward Winslow; Elizabeth, his wife; and 2. men servants, caled Georg Sowle and Elias Story; also a litle girle was put to him, caled Ellen, the sister of Richard More.

William Bradford, and Dorothy, his wife; having but one child, a sone, left behind, who came afterward.

Mr. Isaack Allerton, and Mary, his wife; with 3. children, Bartholmew, Remember, and Mary; and a servant boy, John Hooke.

Mr. Samuell Fuller, and a servant, caled William Butten. His wife was behind, and a child, which came afterwards.

John Crakston, and his sone, John Crakston.

Captin Myles Standish, and Rose, his wife.

Mr. Christopher Martin, and his wife, and 2. servants, Salamon Prower and John Langemore.

Mr. William Mullines, and his wife, and 2. children, Joseph and Priscila; and a servant, Robart Carter.

Mr. William White, and Susana, his wife, and one sone, caled Resolved, and one borne a ship-bord, caled Peregriene; and 2. servants, named William Holbeck and Edward Thomson.

Mr. Steven Hopkins, and Elizabeth, his wife, and 2. children, caled Giles, and Constanta, a doughter, both by a former wife; and 2. more by this wife, caled Damaris and Oceanus; the last was borne at sea; and 2. servants, caled Edward Doty and Edward Litster.

Mr. Richard Warren; but his wife and children were lefte behind, and came afterwards.

John Billinton, and Elen, his wife; and 2. sones, John and Francis.

Edward Tillie, and Ann, his wife; and 2. children that were their cossens, Henery Samson and Humillity Coper;

John Tillie, and his wife; and Eelizabeth, their doughter.

Francis Cooke, and his sone John. But his wife and other children came afterwards.

Thomas Rogers, and Joseph, his sone. His other children came afterwards.

Thomas Tinker, and his wife, and a sone.

John Rigdale, and Alice, his wife.

James Chilton, and his wife, and Mary, their dougter. They had an other doughter, that was maried, came afterward.

Edward Fuller, and his wife, and Samuell, their sonne.

John Turner, and 2. sones. He had a doughter came some years after to Salem, wher she is now living.

Francis Eaton, and Sarah, his wife, and Samuell, their sone, a young child.

Moyses Fletcher, John Goodman, Thomas Williams, Digerie Preist, Edmond Margeson, Peter Browne, Richard Britterige, Richard Clarke, Richard Gardenar, Gilbart Winslow.

John Alden was hired for a cooper, at South-Hampton, wher the ship victuled; and being a hopfull yong man, was much desired, but left to his owne liking to go or stay, when he came here; but he stayed, and maryed here.

John Allerton and Thomas Enlish were both hired, the later to goe mr of a shalop here, and the other was reputed as one of the company, but was to go back (being a seaman) for the help of others behind. But they both dyed here, before the shipe returned.

There were allso other 2. seamen hired to stay a year here in the country, William Trevore, and one Ely. But when their time was out, they both returned.

These, being aboute a hundred sowls came over in this first ship; and began this worke, which God of his goodnes hath hithertoo blesed; let his holy name have the praise.

ing spray. Once the main beam buckled and repairs had to be made in mid-ocean.

Land at Last

"After longe beating at sea," wrote William Bradford, later governor of Plymouth, "they fell with that land which is called Cape Cod; the which being made and certainly known to be it, they were not a little joyfull." Their joy soon turned to fear, for the *Mayflower* met, perhaps, her greatest danger on this day, November 19 (or November 9 according to the old style of reckoning—*see* Calendar).

When Captain Jones headed south off the eastern coast of the cape, the vessel was caught in the scarcely submerged sandbars southeast of present-day Chatham. For hours it appeared that the ship would run aground and be wrecked. Then a change in the wind enabled the captain to extricate it. He sailed northward to the head of the cape, finally mooring in Provincetown Harbor, Saturday, November 21.

SIGNING THE MAYFLOWER COMPACT

Here we see the Pilgrim Fathers solemnly signing the document that combined them in a "civill body politick." These bearded men appear old to modern eyes; but most of the passengers were young. Only six men had passed 40, and 33 were children under 15.

The Pilgrims had reached land at a point north of "Virginia" where their patent called for settlement. Thus they were outside the jurisdiction of the London Company. Some form of government was needed, since a few of the "strangers" were threatening to "use their own libertie" on landing. Before the ship anchored they drew up the Mayflower Compact and all men known to be of age signed it. It read:

> "In ye name of God, Amen. We, whose names are underwriten, the loyall subjects of our dread soveraigne Lord, King James, by ye grace of God, of Great Britaine, Franc & Ireland king, Defender of ye faith, etc. Haveing undertaken for ye glorie of God, and advancements of ye Christian Faith and honour of our king and countrie, a Voyage to plant ye first Colonie in ye Northerne parts of Virginia, doe by these presents solemnly & mutualy in ye presence of God, and one of another, covenant & combine ourselves togeather into a civill body politick; for our better ordering & preservation & furtherance of ye ends aforesaid; and by vertue hereof to enacte, constitute, and frame such just & equall lawes, ordinances, acts, constitutions & offices, from time to time, as shall be thought most meete & convenient for ye generall good of ye colonie, unto which we promise all due submission and obedience."

Rest and worship kept the Pilgrims aboard the ship through Sunday. On Monday the women were rowed to the snowy shore to wash two months' accumulation of soiled clothes. The men began repairing their shallop, or open boat. This they used in a month's exploration of the area to find the best site for settlement. It was December 21 when they finally landed at their chosen spot, Plymouth (*see* Plymouth, Mass.).

MAYFLY. These delicate-winged insects, with long threadlike tails, appear suddenly in great swarms in the late spring or early summer and then die. They are called Mayflies, shad flies, day flies, or ephemera. They swarm about the globes of street lights, settle in helpless masses on windows and sidewalks, or cover the surfaces of lakes with their bodies. Lighthouse keepers on the Great Lakes often have difficulty in keeping their lights clear of them.

Adult Mayflies cannot eat food, either liquid or solid, and they live only long enough to reproduce. Once it was thought that they lived only a single day, but more careful study has shown that they may remain alive from a few hours to about a week.

The eggs, in large numbers, are laid in the water and sink to the bottom. The larvae are strong and active creatures. They spend from one to three years, according to the species, in swimming about, crawling on the bottom, or burrowing in the ooze, meanwhile feeding on tiny animals and vegetable life.

When fully grown, they rise to the surface, burst their skins, and fly away in huge swarms. At this time they pass through what is called the *subimago* stage. After the winged adults emerge from the water they shed their skin again, and the full *imago*, or adult, emerges. Often its colors are very different from those of the *subimago*. No other insects pass through this change.

Fish devour Mayflies greedily, and many of the artificial flies used by anglers are imitations of these insects. May flies belong to a very old and primitive type of insect. Fossils of their ancestors have been found in Coal Age deposits. The scientific name of the Mayfly order is *Ephemeroptera*.

MAZZINI (*māt-sē'nē*), GIUSEPPE (1805–1872). Italy was "a mere geographical expression," made up as it was of many small states, when Mazzini, the "Prophet of Italian Unity" was born. He gave his life to the cause of uniting the country and freeing it from foreign rule. He lived to see Italy united, but he died a disappointed man, for the country became a kingdom and not the republic he had sought.

The son of a professor of medicine at the University of Genoa, Mazzini was a bright but sensitive lad. He entered the university early and was graduated in law at 21. Literature was his first interest, and his writings received praise. However, he soon gave up literature and used his pen to rouse the Italians to fight for liberty and unity.

He joined the Carbonari, a patriotic secret society, and was arrested and imprisoned in 1831. After his release he fled to Marseilles where he announced the principles of a new revolutionary secret organization called "Young Italy" (*see* Italy).

Though Mazzini was compelled to live in exile most of his life, his writings, in tracts, liberal publications, and letters, spread his society throughout Italy. He was the most untiring political agitator in Europe, the man most dreaded by its absolute governments. In his constant struggle with poverty, he mastered French and English so he could write essays for foreign journals.

He helped plot insurrections in Italian cities and returned to Italy on the outbreak of the Lombard revolt in 1848. When a republic was proclaimed at Rome, Mazzini was chosen one of three triumvirs to govern it. In June 1849, however, the republic fell before French troops, and he again fled.

Mazzini was a great leader of men, but he could not work well with others. He would not compromise. This led to difficulties between him and the other leaders of the unity movement—Garibaldi, its military hero; and Cavour, the statesman who made the plans which finally brought union. Mazzini took no part in the monarchial government, though elected to parliament from Messina. He died in Pisa in 1872.

MEADE, GEN. GEORGE GORDON (1815–1872). In June 1863, the Union faced its darkest days in the Civil War. The Confederate army under Gen. Robert E. Lee, unbeaten in two years of war, was striking north into Pennsylvania. The northern people were panic-stricken. New leadership was needed for the Army of the Potomac and, in the early morning of June 28, Gen. George G. Meade was given command. So intense was criticism of Union generals at the time that he thought at first the appointment was an order for his arrest.

Meade felt unequal to his task, but actually he had been prepared by a lifetime of training. He was born in Cadiz, Spain, the son of a United States naval agent. Young George won an appointment to West Point in 1831 and received a military education. In 1836, a year after graduation, he resigned from the Army and worked as a civil engineer. Meade was married in 1840 and returned to the Army in 1842.

He served well in the Mexican War, and when the Civil War broke out he became a brigadier general of volunteers. At the time of his sudden appointment to lead the Army of the Potomac, he was commander of the V Corps.

On July 1, three days after this appointment, a surprise encounter plunged his army into the battle of Gettysburg, the greatest ever fought on American soil (*see* Gettysburg). Through three days of terrific fighting, Meade defeated all Confederate attacks and Lee acknowledged defeat by withdrawing to Virginia.

Meade was severely criticized at the time for failing to pursue and crush the shaken Confederates. He had defeated Lee at least; and in 1864 he received the thanks of Congress and was commissioned a major general in the regular army. He retained his command until the end of the war; but after Gen. Ulysses S. Grant took over all Union forces in March 1864, Meade had only nominal leadership of the Army of the Potomac.

After the war, Meade commanded the division of the Atlantic, 1865–66; the department of the east, 1866–67; and later the military district which included Georgia, Alabama, and Florida. His headquarters after the war were in Philadelphia. He died there Nov. 6, 1872.

MEADOWLARK. Among the first of the songbirds to fly north after the winter migration is the meadowlark. Its sweet, plaintive whistle brings a promise of spring to frosty brown fields and marshes.

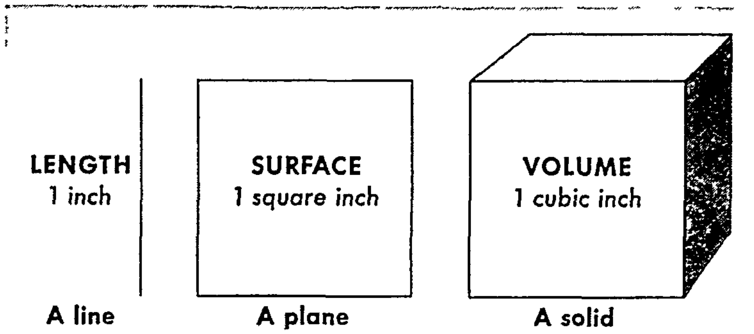
It is distinctly an American bird. Although a close relative of the blackbird, and not a lark at all, it has a larklike fashion of nesting on the ground and of singing on the wing above its meadow home.

The meadowlark is about 10½ inches long. Its feathers are brown streaked with black, its breast is a bright, black-spotted yellow, adorned with a striking crescent of glossy black feathers just below the throat. The nest, with three to seven brown-spotted white eggs, is cleverly hidden in the grass. The mother bird may wait until an intruder is almost on her before she flies up and away. She is a bit smaller than her mate, and her plumage is a shade paler. (For pictures in color, *see* Birds; Egg.)

Besides offering beauty and a sweet song call, the meadowlark is useful. More than half its food is harmful insects, and much of the other half is weed seed. It fills out the diet with grass seed and some grain. For many years it was shot as a game bird, but now it is protected by law.

Meadowlarks breed throughout the United States and in Canada. They move southward as cold weather approaches, though they often winter in the Northern states. The western meadowlark is similar to the eastern species, but it is a little smaller and grayer, and the breast yellow is somewhat deeper. Its song is far more beautiful than that of its eastern relative. It is the state bird of Kansas, Montana, Nebraska, North Dakota, Oregon, and Wyoming. The scientific name of the eastern meadowlark is *Sturnella magna;* of the western meadowlark, *Sturnella neglecta.*

MEASURING SURFACES *and* VOLUMES

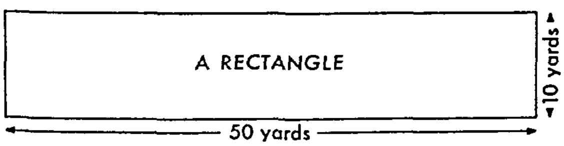


MEASUREMENT. The branch of arithmetic that is concerned with measurements of lengths, surfaces, and volumes is called *mensuration.* Mensuration, like geometry, deals with so-called geometrical figures, such as squares, triangles, circles, cubes, spheres, and cylinders. Measurements of these figures are much used in surveying land, in building, plastering, and papering, in drawing and engineering, and in finding the capacity of boxes, tanks, and ships.

All measurements of surface and volume are based upon measurements of length. The chief common units of length in English-speaking countries are the inch, the foot, the yard, the rod, and the mile. (For the origin of these units and for tables of English and metric measures, *see* Weights and Measures; *see also* Metric System.)

The Perimeter of a Plane Figure

Linear measure is the measurement of a line. A line has only one dimension—length. A plane, or flat, surface has two dimensions—length and width. The perimeter of a plane figure is the distance around it. The measurement of a perimeter is expressed in linear units.



The figure above is a scale drawing of a garden plot 50 yards long and 10 yards wide. Each half inch represents 10 yards. The garden plot is in the form of a *rectangle.* A rectangle is a figure with four straight sides and four square corners.

Suppose we want to know how many yards of fence will be required to enclose this rectangle. The perimeter is seen to be 2 times the length plus 2 times the width. Calling the perimeter P, the length l, and the width w, we can write the formula for the perimeter of any rectangle:

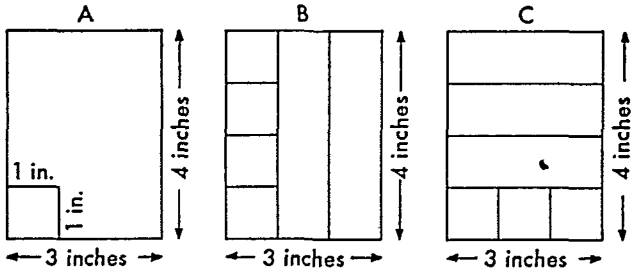
$$\text{Perimeter} = 2 \times \text{length} + 2 \times \text{width},$$
$$\text{or } P = 2l + 2w, \text{ or } P = 2\,(l + w)$$

The number of yards of fence required is $2\times50+2\times10=100+20=120$, or $2\,(50+10)=2\times60=120$.

Measurement of Surface, or Area

We have seen that we measure length by finding out how many *linear units* of a certain standard size are contained in the line we are measuring. We measure area by finding out how many *square units* of a certain size are contained in the surface we are measuring. The square units commonly used are the square inch, the square foot, the square yard, the square rod, the acre, and the square mile.

The Rectangle. Figures A, B, and C are small scale drawings of a rectangle that measures 3 inches by 4 inches. Each $\frac{1}{4}$ inch in the scale drawings represents



1 inch. The small square in the corner of A represents a square 1 inch long and 1 inch wide (a square inch).

B shows the same rectangle divided into 3 vertical strips. One of the 3 strips is divided into 1-inch squares. We see that there are 4 square inches in 1 strip. Then in 3 strips there are 3 times 4 square inches, or 12 square inches.

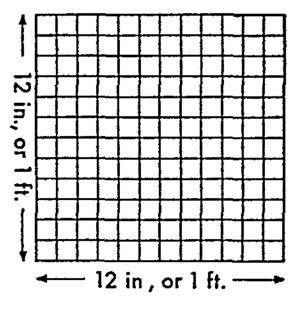
C is divided into 4 horizontal strips. One of the strips is divided into 3 square inches. Then in the 4 strips, there are 4 times 3 square inches, or 12 square inches. We see that the area of a rectangle in square inches is equal to the length in inches times the width in inches. If the dimensions were given in feet, the area would be in square feet; if in yards, the area would be in square yards; and so on.

If A stands for area, l for length, and w for width, the formula for the area of a rectangle is:

$$\text{Area}=\text{length}\times\text{width}, \text{ or } A=l\times w, \text{ or } A=lw$$

If the sides of a rectangle are all equal, the rectangle is a square. If we call one side of a square s, the area of a square is given by the formula:

$$\text{Area} = \text{side} \times \text{side},$$
$$\text{or } A = s \times s, \text{ or } A = s^2$$



We read s^2 as "s squared." (*See* Powers and Roots.)

Using this formula, we can work out the units of square measure. If a square is 1 foot long and 1 foot wide, its area is 1 square

foot. Since there are 12 inches in a foot, the area of a square foot is 12×12, or 144 square inches. Thus there are 144 square inches in one square foot.

If a square is 3 feet long and 3 feet wide, the area is 9 square feet, or 1 square yard.

A rod is $16\frac{1}{2}$ feet. An acre contains 160 square rods. The area of a field 80 rods long and 40 rods wide is 80×40, or 3,200 square rods. Dividing 3,200 by 160 we find the number of acres to be 20.

The Parallelogram. Parallel lines may be defined as lines that run in the same direction and never meet. A parallelogram is a four-sided plane of which the opposite sides are parallel. All rectangles are parallelograms but not all parallelograms are rectangles.

Either pair of opposite sides may be called the *bases*. The *altitude* is measured by the *perpendicular* between the bases. The perpendicular is a line that forms square corners with the base line. In a rectangle the altitude, or perpendicular, is a side of the figure.

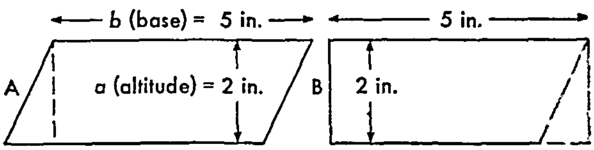
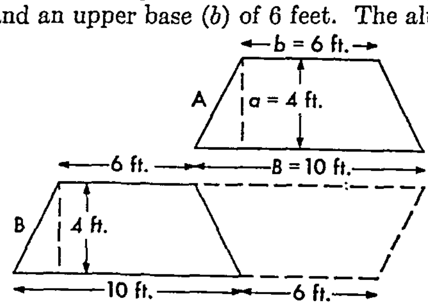


Figure A is a parallelogram. If we cut along the dotted line, turn over the cut-off piece, and move it to the other side, we have a rectangle (B). The area of this rectangle is 2×5, or 10 square inches. The formula for the area of a parallelogram is therefore:

$$\text{Area} = \text{altitude} \times \text{base, or } A = ab$$

The Trapezoid. A trapezoid has only two parallel sides—the bases. Figure A has a lower base (B) of 10 feet and an upper base (b) of 6 feet. The altitude



(a) is 4 feet. If two such trapezoids are placed end to end, as in Figure B, they form a parallelogram. Each base is equal to $B+b$, or 10 feet+6 feet, or 16 feet. The area is 4×16, or 64 square feet. The area of the trapezoid is one half the area of the parallelogram, which is $A=ab$. Then the area of a trapezoid is given by the formula:

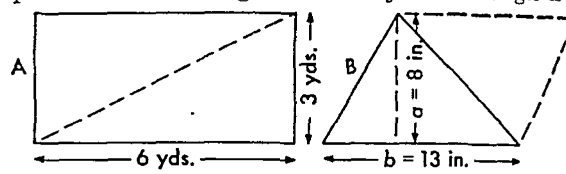
$$A = \frac{a(B+b)}{2}$$

The area is found as follows:

$$A = \frac{4(10+6)}{2} = \frac{4\times 16}{2} = \frac{64}{2} = 32 \text{ (sq. ft.)}$$

Another way to express the area of a trapezoid is to say that it is equal to the product of the altitude and the average of the two bases.

The Triangle. Figure A shows a rectangle divided into two equal parts by a *diagonal*. Each of the two parts of this rectangle is a *triangle*. A triangle is a



plane figure with three straight sides. We know that the area of a rectangle is given by the formula $A=lw$, or $A=ab$. Then the area of a triangle is given by the formula:

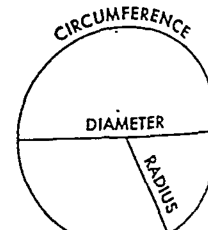
$$A = \tfrac{1}{2}ab, \text{ or } A = \frac{ab}{2}$$

Each of the triangles in Figure A has a base of 6 yards and an altitude of 3 yards. The area of one triangle is found as follows:

$$A = \frac{3\times 6}{2} = 9 \text{ (sq. yds.)}$$

The shaded triangle in Figure B has a base of 13 inches and an altitude of 8 inches. The area is $\frac{8\times 13}{2}=$ 52 square inches.

The Circle. If you will measure the distance around a circular tin can with a tape measure, you will have the *circumference* (C) of the circle. If you measure the widest distance across the circle (through the center) you will have the *diameter* (D). Compare the two measurements and you will find that the circumference is a little more than three times the diameter. This will be true no matter how many circles of different sizes are measured. The ratio is very nearly $3\frac{1}{7}$, or 3.14. Given to four decimal places it is 3.1416. For convenience in writing, the number is usually represented by the Greek letter π, called *pi.* The formula for the circumference of a circle is therefore $C=\pi D$.

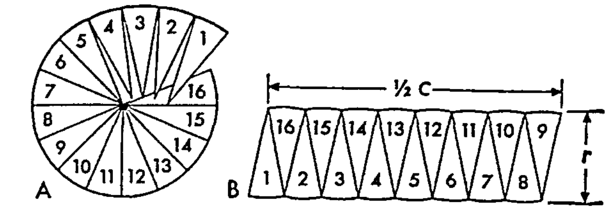


One half the diameter is called the *radius* (r). The radius is the distance from the center to the circumference. In other words, the diameter (D) is 2 times the radius (r). Then, the formula for the circumference of a circle ($C=\pi D$) can be written as follows if we substitute $2r$ for D: $C=2\pi r$.

The radius of a circular flower bed is $10\frac{1}{2}$ feet. Substituting $3\frac{1}{7}$ for π and $10\frac{1}{2}$ for r in the formula, we find the circumference as follows:

$$C = 2\times 3\frac{1}{7}\times 10\frac{1}{2} = 2\times\frac{\overset{11}{\cancel{22}}}{\underset{1}{\cancel{7}}}\times\frac{\overset{3}{\cancel{21}}}{\underset{1}{\cancel{2}}} = 66 \text{ (ft.)}$$

Figure A shows a circle cut into 16 equal "pieces of pie." B shows the pieces fitted together to make a figure that looks almost like a parallelogram. The figure would look much more like a parallelogram if the circle were divided into many more pieces.



The "base" of this "parallelogram" is equal to one half the circumference of the circle. The altitude is equal to the radius. Since the circumference is equal to $2\pi r$, one half the circumference is equal to πr. Then the area is equal to $\pi r \times r$, or πr^2. This gives us the formula for the area of a circle:

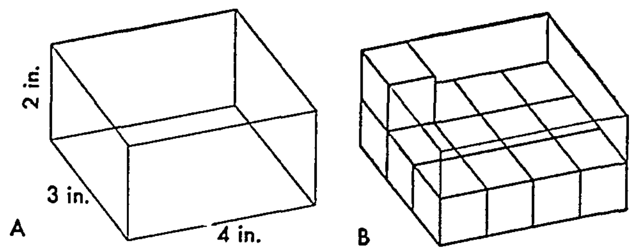
$$A = \pi r^2$$

A circular flower bed has a radius of $10\frac{1}{2}$ feet. Substituting $3\frac{1}{7}$ ($\frac{22}{7}$) for π and $10\frac{1}{2}$ ($\frac{21}{2}$) for r, we find the area as follows:

$$\frac{\overset{11}{\cancel{22}}}{\underset{1}{\cancel{7}}} \times \frac{\overset{3}{\cancel{21}}}{\underset{1}{\cancel{2}}} \times \frac{21}{2} = \frac{693}{2} = 346\frac{1}{2} \text{ (sq. ft.)}$$

The Measurement of Solids

When we measure the volume of a solid object, such as a box or a brick, we discover how many cubic inches, or cubic feet, or cubic yards it contains.



Rectangular Solid. If each side, or *face*, of a solid is a rectangle, the solid is called a *rectangular solid*, or *rectangular prism*. A rectangular solid has three dimensions—length, width, and height. If you will look carefully at Figure A you will see that it has 6 rectangular faces, 12 edges, and 8 corners.

Figure B has the same dimensions as Figure A. It shows that Figure A could contain two layers of 1-inch cubes. The number in each layer is 4×3, or 12. In the two layers, then, there are 4×3×2, or 24 cubic inches. This shows that the formula for finding the volume of a rectangular prism is:

$$\textit{Volume} = \textit{length} \times \textit{width} \times \textit{height}, \text{ or } V = lwh$$

We also see that the volume of a rectangular solid is equal to the area of the base times the height.

If the three dimensions of a rectangular prism are all equal, the prism is a *cube*. Each of the 6 faces of a cube is a *square*. We find the volume of a cube by cubing one dimension, or edge (*see* Powers and Roots). Calling the edge e, we have the following formula for the volume of a cube:

$$V = e \times e \times e, \text{ or } V = e^3$$

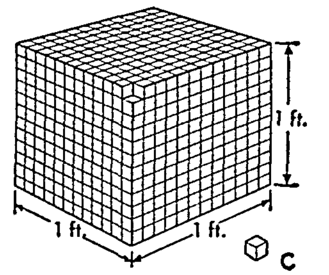
We read e^3 as "e cubed."

The volume of a 10-inch cube is 10^3, or 10×10×10, or 1,000 cubic inches.

Using the formula for the volume of a cube, we can rediscover any of the units of cubic measure. The bottom layer of Figure C contains 12 rows of 1-inch cubes with 12 cubes in each row. In each layer there are 144 cubes, just as there are 144 square inches in a square foot. In all 12 layers there are 12×144 cubic inches, or 1,728 cubic inches.

If we know there are 3 feet in a yard, we can easily rediscover the number of cubic feet in a cubic yard (3×3×3, or 3^3, or 27 cubic feet).

The total surface of a rectangular solid consists of the two bases (top and bottom), the two sides, and the two ends. The area of the two bases is $2lw$; the area of the two sides is $2lh$; and the area of the two ends is $2wh$. The total area is given by the formula:



$$A = 2lw + 2lh + 2wh$$

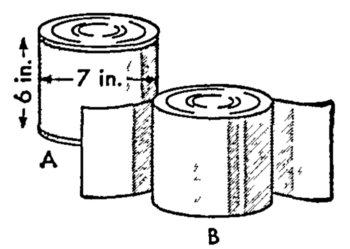
The total area of Figure A is 2×4×3+2×4×2+2×3×2, or 24+16+12, or 52 square inches.

If an edge of a cube is e, the total surface of a cube is given by the formula:

$$A = 6e^2$$

The Cylinder. A solid that has the shape of an ordinary tin can or a drum is a cylinder. The two bases of a cylinder are circular in shape.

We have seen that the volume of a rectangular solid is equal to the area of the base times the height. The volume of a cylinder is also equal to the area of the base times the height. If the radius of the base is r, the area of the base is πr^2. Then the volume of a cylinder is given by the formula:



$$V = \pi r^2 h$$

Figure A shows a can 7 inches in diameter and 6 inches high. Since the diameter is 7 inches, the radius is $3\frac{1}{2}$ inches. The volume of the cylinder is found as follows:

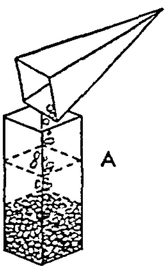
$$V = \frac{\overset{11}{\cancel{22}}}{\underset{1}{\cancel{7}}} \times \frac{\overset{1}{\cancel{7}}}{\underset{1}{\cancel{2}}} \times \frac{7}{\underset{1}{\cancel{2}}} \times \overset{3}{\cancel{6}} = 231 \text{ cu. in. (1 gallon)}$$

The surface of a cylinder consists of 2 circular ends and the curved side, which is called the *lateral surface*. We can find the lateral surface of a tin can by removing the label (Figure B). When the label is spread out, it has the shape of a rectangle. The length is the same as the circumference of the circle, or $2\pi r$. The width is the same as the height (h) of the cylinder. Then the area is $2\pi rh$. The area of the 2

ends is $2\pi r^2$. The total area of a cylinder is given by the formula:

$$A = 2\pi r^2 + 2\pi rh$$

The Pyramid. A pyramid has sloping sides that come to a point at the top. The base may be a triangle, a rectangle, a square, or some other kind of polygon. (A polygon is a plane figure with three or more straight sides.)



A

A simple experiment shows that the volume of a pyramid is one third the volume of a prism having an equal base and an equal height. Figure A shows gravel being poured out of a square pyramid into a square prism. The pyramid and prism have the same base and height. When all the gravel has been poured in, the prism will be one-third full.

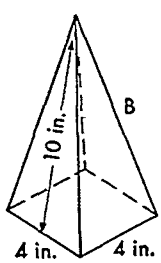
The formula for the volume of a rectangular prism is $V=lwh$. The formula for the volume of a pyramid is:

$$V = \tfrac{1}{3}\,lwh$$

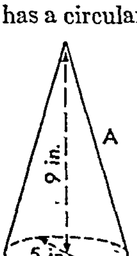
in which V is the volume, l is the length of the base, w is the width of the base, and h is the height.

The volume of a pyramid having a 6-inch square base and a height of 8 inches is found as follows: $V=\frac{1}{3}\times6\times6\times8=96$ cubic inches.

The sides of a pyramid are triangles. The total area of the sides is called the *convex surface*. If the pyramid is a square pyramid, there are four of these triangles. The *slant height* of the pyramid in Figure B is the altitude of a triangular side (10 inches). Since the area of a triangle is one half the product of the base and the altitude, the total area of all four of these triangles is one half the product of the sum of the bases and the altitude. The sum of the bases in Figure B is 16 inches (the perimeter of the base). Then the area of the sides of this pyramid is found as follows: $A=\frac{1}{2}\times10\times16=80$ square inches. The *total* surface area is 80 square inches+16 square inches (the area of the base), or 96 square inches.



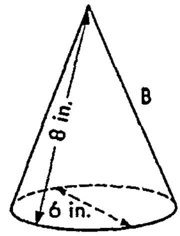
The Cone. A cone differs from a pyramid in that it has a circular base. The cone represented by Figure A has a base with a diameter of 5 inches and a height of 9 inches. The volume of a cone, like the volume of a pyramid, is equal to one third the product of the base area (B) and the height (h); that is:



$$V=\tfrac{1}{3}Bh$$

The area of the base is the area of a circle with a radius of 2.5 inches. Then, the volume of this cone is found as follows, using 3.14 for π: $V=\frac{1}{3}\times 3.14 \times 2.5 \times 2.5 \times 9 = 58.875$ cu. in.

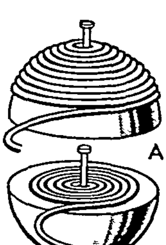
The method described for finding the area of the convex surface of a pyramid suggests the method for finding the area of the convex surface of a cone. The area of the convex surface of a cone is equal to one half the product of the circumference of the base and the slant height. The circumference of the base in Figure B is 3.14×6, or 18.84 in. Then the area of the convex surface is $\frac{1}{2}\times8\times18.84$, or 75.36 square inches. The area of the base, of course, is $3.14\times3\times3$, or 28.26 square inches. Then the total area of the surface of this cone is 75.36 square inches + 28.26 square inches, or 103.62 square inches.



The Sphere. Figure A shows a cork ball cut in half. A pin was placed in the center of the flat surface of one of the halves and in the center of the curved surface of the other half. Measuring the twine coiled about the pins reveals an interesting fact. The amount required to cover the *curved* surface is just twice as much as that required to cover the *flat* surface. This shows that the area of the surface of a hemisphere (a half-sphere) is twice that of a circle having the same radius. We know that the area of a circle is given by the formula: $A=\pi r^2$. Then, the area of the surface of a hemisphere is $2\pi r^2$, and the area of the surface of the entire sphere is given by the formula:

$$A = 4\pi r^2$$

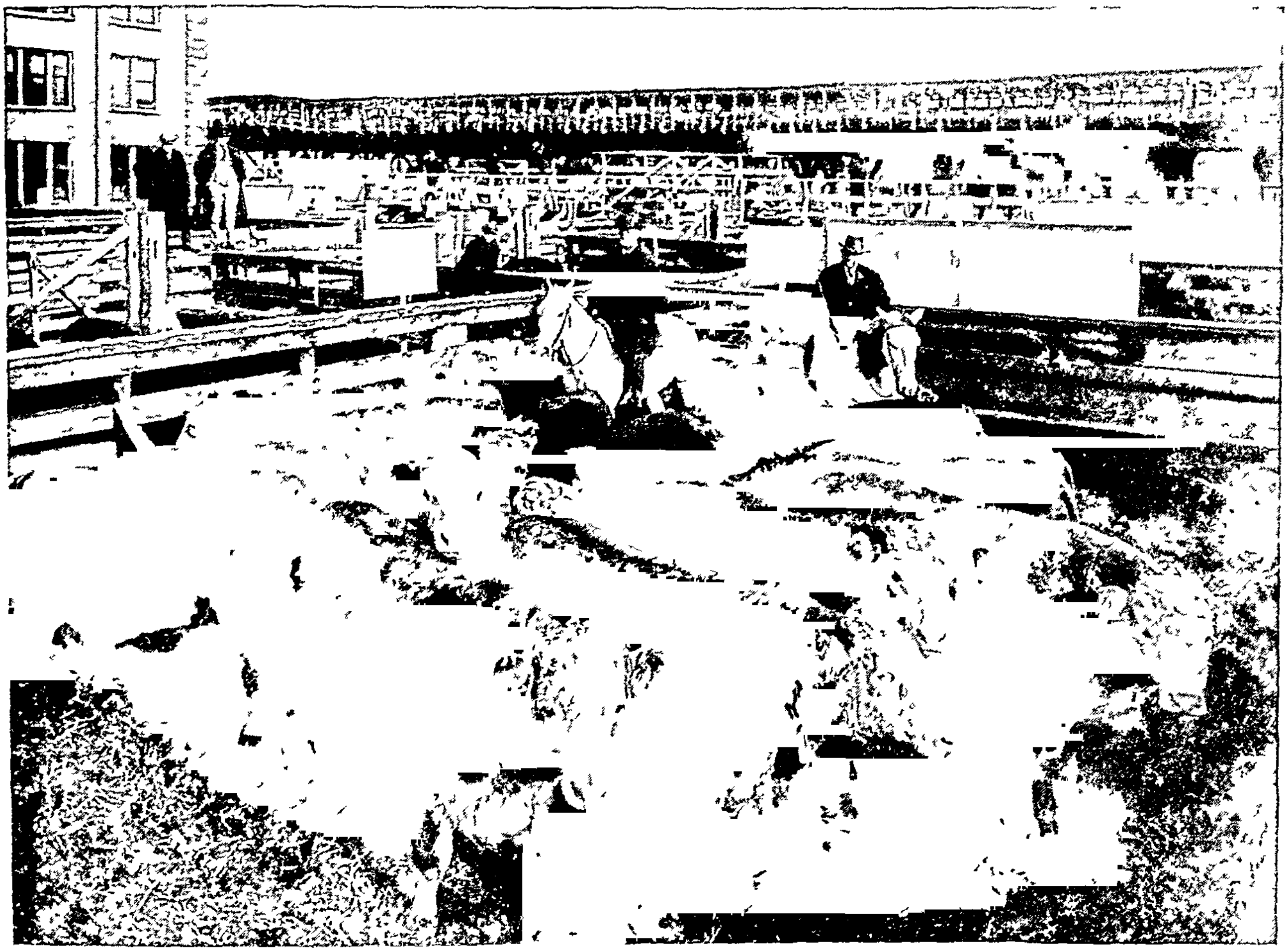
We may think of a sphere as made up of many pieces that resemble pyramids, as shown by Figure B. We know that the volume of a pyramid is $V=\frac{1}{3}Bh$. In this case, the height is the same as the radius of the sphere. The volume of each "pyramid" is therefore $\frac{1}{3}Br$. The sum of the bases of all the pieces is the surface of the sphere, or $4\pi r^2$. Substituting $4\pi r^2$ for B, we have a formula for the volume of the sphere:



$$V=\tfrac{1}{3}\times4\pi r^2\times r,\ \text{or}\ V=\tfrac{4}{3}\pi r^3$$

If we compare the volume of a sphere with a cylinder having a diameter and height equal to the diameter of the sphere, we find the volume of the cylinder is half again as much as the volume of the sphere.

If we compare the volume of a sphere with the volume of a cone that has a base diameter and a height equal to the diameter of the sphere, we find that the volume of the cone is just one half that of the sphere. (*See also* Geometry.)



Each commission man who does business in the stockyards has pens like this into which the cattle consigned to him are unloaded. The men on horseback who are looking them over are buyers Most of the buyers represent the large packing companies.

Preparing MEAT *and* ANIMAL BY-PRODUCTS *for Market*

MEAT PACKING. The term "meat packing" comes to us from early times in America. In colonial days farmers killed hogs in the fall. Then they salted the pork and packed it in barrels for use through the winter. Today most of our meat is prepared in huge factories called packing houses. So to us the term "meat packing" means killing animals and preparing meat by factory methods. It also includes distributing meat to stores.

The meat industry reaches into every part of the country. It is one of the largest industries in the United States. Millions of farmers and ranchers raise hogs, cattle, and sheep. Thousands of people work summer and winter, by day or by night, taking the animals to livestock markets. More than 200,000 people work for the "packers" (the meat-packing companies), preparing meat and carrying it to the stores.

Huge Modern Stockyards

A farmer or rancher may sell meat animals in several ways. He may sell them to a "country buyer" (an independent dealer), he may offer them at a local community auction, or he may market them through a local farmers' co-operative association. Whatever method he chooses, his stock is usually shipped to a great public receiving point and market, called a "stockyard." If he has enough animals to fill a truck or a railway stock car, he may send them direct to the nearest "yard."

A modern stockyard is like a huge hotel for livestock. The Union Stockyards at Chicago cover 325 acres (more than half a square mile) and have more than 7,000 pens. Some pens are large enough to hold a carload of animals.

Most of the animals arrive at night. Nearby farmers bring many in hundreds of trucks. Long trains of stock cars bring many more over 28 railroad lines. The Union Stockyards are equipped to handle about 75,000 cattle and 400,000 hogs and sheep at any time. Other large yards are located at Kansas City, Omaha, Fort Worth, East St. Louis, and South St. Paul.

Early in the morning, the commission men stand by the pens to sell the animals. Buyers ride by, inspect the stock, and make offers to buy. When a commission man agrees to sell, the animals are driven into a weighing house. The sale is made by "hundredweight"—that is, how much the entire penful of animals weighs in hundreds of pounds. The buyer pays the commission company immediately. That night the

company sends the farmer or rancher a check for the amount, after deducting its commission for making the sale and all shipping expenses. If any animals are not sold by the end of the day, the stockyard company must supply them with water and feed. It charges the owner a daily fee for this service.

Anyone can use the services of a stockyard to buy or sell. Farmers buy cattle and sheep that need fattening ("feeders") and animals to stock their farms ("stockers"). But the largest share of the animals goes to the packers for immediate slaughter.

How Animals Are Turned into Meat

Animals are killed and meat is prepared in packing houses near the yards. The animals are driven up ramps to holding pens at the top of the slaughter houses. The next processes vary, according to the kind of animal.

The hogs pass through a narrow passageway into a small shackling pen. A workman slips a shackle over a hind leg of each hog and attaches the shackle to an elevator. The elevator lifts the hog, hanging head down, to an overhead conveyer. Then a slaughterer slits its throat. Next the carcass rides through a scalding vat, which loosens the hair. Then it passes through a scraping machine. Workmen shave off any hairs that are left, and the carcass goes through a shower bath. Then one workman cuts off the head, another slits the belly, and still others remove the entrails and pull out the leaf lard. Twenty-five minutes after a hog is killed its meat goes into the cooler. The meat remains here from 36 to 48 hours.

As the chilled meat rides out of the cooler it falls to a moving table and passes a line of workmen. Each workman cuts off a single portion and drops it down a chute to a conveyer belt. Cuts that are to be sold fresh go to the shipping room; those that are to be cured go to the curing cellars.

Sheep are killed in the same way as hogs. Cattle are stunned with a hammer before killing except those reserved for the *kosher* market. Kosher animals are tied up, then killed (by a Jewish slaughterer) in a way that ensures thorough bleeding. Skilled skinners remove the pelts from sheep and cattle in one piece. Beef is shipped out in "sides," "quarters," or "wholesale cuts." Usually lamb carcasses are not cut up.

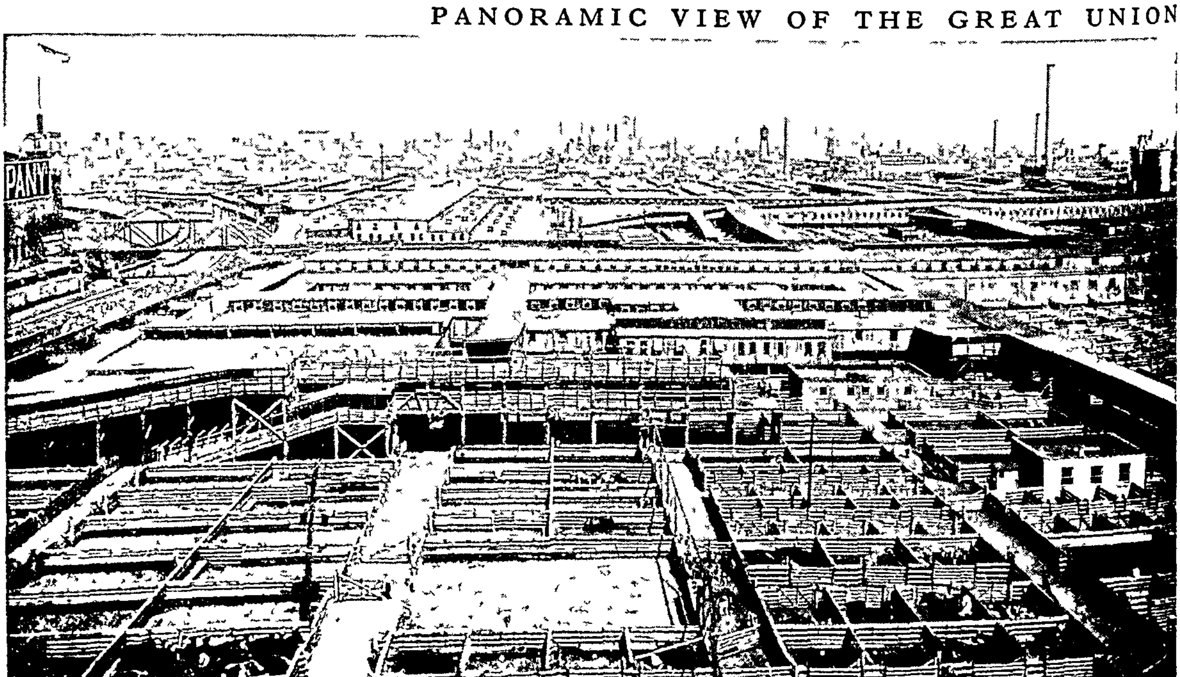
United States government inspectors must approve every live animal and carcass in plants that sell meat in interstate commerce. On good meat they imprint a round stamp, using a pure vegetable ink: "U. S. Inspected and Passed." Condemned meat cannot be used for food.

Preserved by Refrigeration and Curing

If meat is frozen solid, it can be kept many months. Americans prefer fresh meat, however. Therefore the packers freeze only a small proportion—chiefly the cuts they intend to use later in cured meat products. They "chill" the rest by keeping it in cold storage at a temperature above freezing. The packer must sell chilled meat within a few weeks.

Ham is cured by placing it in a sweet pickle solution, made up chiefly of salt, sugar, and water. In the "quick cure" method some of the solution is injected into the ham to spread through the veins. Bacon is generally dry cured. A curing mixture, chiefly sugar and salt, is spread over each layer. Then the meat is packed in watertight containers under

PANORAMIC VIEW OF THE GREAT UNION



This picture shows the north portion of the huge stockyards maintained in Chicago by a union company to serve the livestock and meat-packing industry. In facilities and arrangement, the yard is a marvel of efficiency. During the early morning, stock trains from the Middle West pour in over the tracks seen in the upper left-hand corner, and the animals are distributed to pens.

pressure so that the juice from the meat mixes with the curing mixture.

After curing, the hams and bacon go to the smokehouse. Fragrant fumes of burning hardwood give them their distinctive flavor. Ham may be partly cooked by raising the temperature during smoking to make it more tender. Ready-to-eat hams are completely cooked in the smokehouse. Curing processes are used also in making smoked beef tongue, dried beef, corned beef, certain canned meats, and sausages (except fresh pork sausages).

By-Products of the Packing Industry

The packer's chief business is processing meat and rendering pork fat into lard. After he has done this, he still has about half the weight of the live cattle and sheep and a fourth of the weight of the hogs. Formerly these were wasted except for sheep wool, and the hides, which are turned into leather. Today practically all the animal is used in some way.

Mutton and beef fat are used in oleomargarine or made into tallow (for soap) or glycerin. Bones yield tallow, glycerin, glue, neat's foot oil, buttons, knife-and-fork handles, bone meal, and bone charcoal. The skin of the hog furnishes gelatin. Hair is used for brushes and upholstery. Intestines are made into tennis strings, violin strings, and surgical ligatures or are used for sausage casings. Glands furnish valuable medicinal products—thyroid and parathyroid, adrenalin, pituitary, and ovarian extracts, pineal extract, and insulin. Stomach linings yield pepsin and pancreatin. Scraps of meat go into canned dog food. Laboratories obtain serum for the culture of bacteria from some of the blood. The blood also furnishes albumen. All the residue, including blood and bones, is made into stock feed, poultry feed, or fertilizer.

The word *meat* in the packing industry does not include poultry. Most packers, however, "pack" poultry as well and also handle eggs, butter, and cheese. These products use the same handling facilities as meat and go to the same retail stores.

How the Meat Reaches the Consumer

The national packers have hundreds of branch selling houses, equipped with cold-storage rooms, in the larger cities and towns. Refrigerator trucks and railway cars deliver the meat from the packers to the branch houses. Each branch house delivers meat to retail stores in 20 or 25 towns within its zone. Salesmen for the packers call on the retailers to take orders.

The retailer cuts up the meat and prices the various cuts according to market demand. He sells some cuts for less than the cost per pound of the entire carcass. For steaks he may get four or five times as much. He must sell all the meat before it spoils.

In the end the housewife determines what the retailer and packer can charge for meat and what the farmer or rancher can get for animals. When national income is high, people will pay high prices for meat. Then the growers increase the supply, and this brings prices down. If prices are low, the growers raise fewer animals, and in time the scarcity of animals brings meat prices up.

How the Packing Industry Grew

As the United States developed, the center of livestock production moved steadily westward. Cin-

STOCKYARDS IN THE HEART OF CHICAGO

There buyers inspect them, and soon a steady stream of livestock starts along the alleys and through the overhead runways, or covered passageways, to the meat-packing establishments, which are to the left of the area shown in the picture. By night most of the animals received have been slaughtered, and the railroads are busy hauling away meat toward the four quarters of the globe.

cinnati set up a packing plant in 1818 and shipped salt pork, ham, and lard down the Ohio River to the eastern markets. For a time it was called "Porkopolis." For fresh meat the eastern cities depended on local slaughterers. "Drovers" bought cattle and sheep from farmers and ranchers in the West and drove them across the country, pasturing them on the way. The trip took several months.

After 1850 the railways pushed into the Middle West. Now the drovers could drive their stock to a railway and send the live animals east in livestock cars. At many railway centers public markets called "stockyards" were established. Here the drovers could sell their stock for cash to eastern buyers. The first large stockyard was set up in Chicago in 1865.

SKILLED WORKMEN SKIN THE CATTLE

At the left men are working on newly killed cattle. In the center, the carcasses are laid flat on their backs and workmen are skinning the bellies. Others skin the rump. Then the carcasses are hung up and the rest of the skin is pulled off without cutting.

Moving live animals by rail was costly. If the animals could be slaughtered near the producing regions and only the meat was shipped east, costs could be much reduced. This problem was solved about 1870 when machines for making artificial ice were perfected (*see* Refrigeration). The first crude refrigerator car, cooled by natural ice, had carried dressed beef from Chicago to the East in 1857.

SCRUBBING THE DRESSED CATTLE

An overhead trolley carries dressed beeves past a washer who scrubs them with a high-powered spray. Then the meat rides to the cooler.

The packers set up their plants close to the public stockyards. Converging railroad lines made Chicago the great meat-packing center of the world. Other packing centers grew up at points that had river transportation as well as railways.

The railways encouraged centralization of the packing industry and the stockyards. But the development of good highways and motor trucks started a trend toward decentralization with small "interior" packing plants near the farms. City packers as well as interior packers now send buyers direct to the producing regions. Direct buying has been made practical by the market news service of the Department of Agriculture. This agency collects information on markets and prices and disseminates it by radio, telegraph, and newspapers.

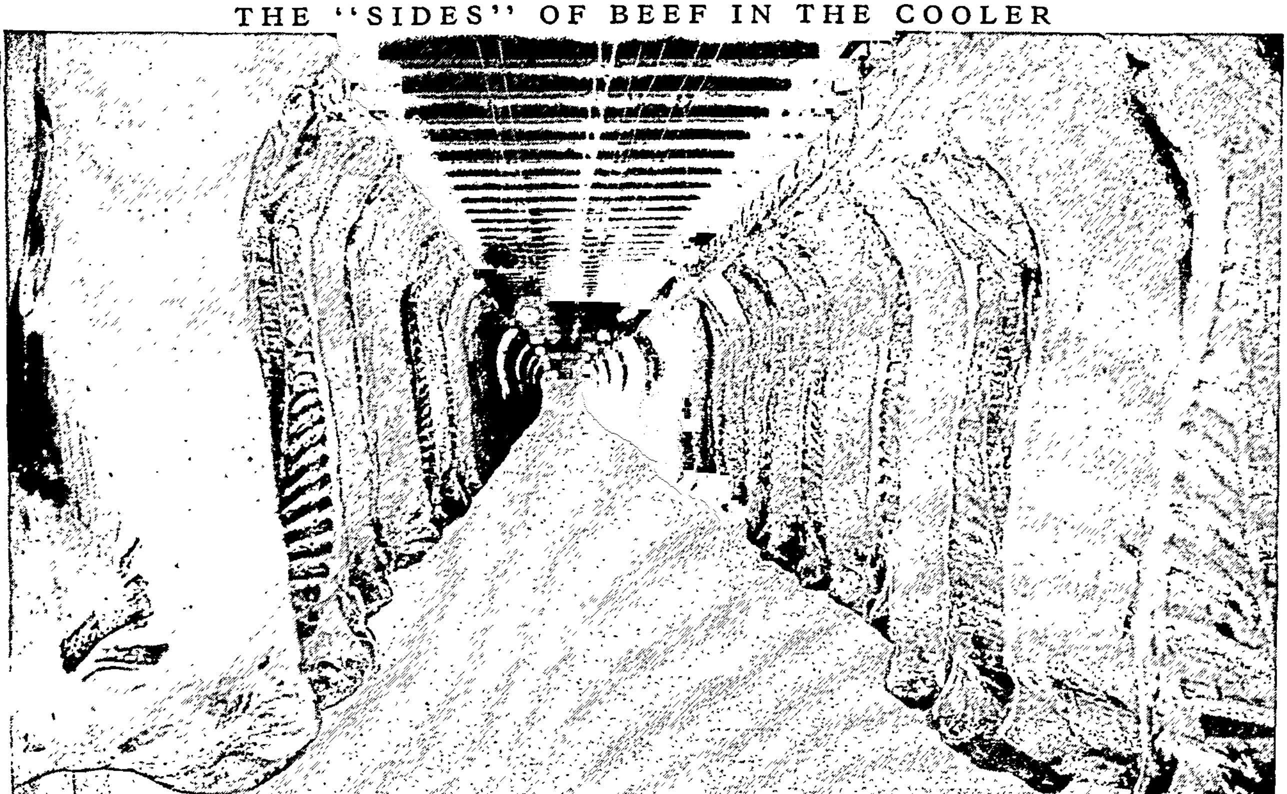
Meat-Eating and Producing Countries

Americans and Canadians eat about 140 to 150 pounds of meat a year; Australians, 200 pounds, and Argentineans and New Zealanders, 300 pounds. The chief exporting countries are Argentina, Australia, Denmark, and New Zealand. The United States is the largest producer but exports little. Britain is the largest importer. (*See* Cattle; Hogs; Sheep.)

FINAL EXAMINATION BY THE GOVERNMENT INSPECTOR

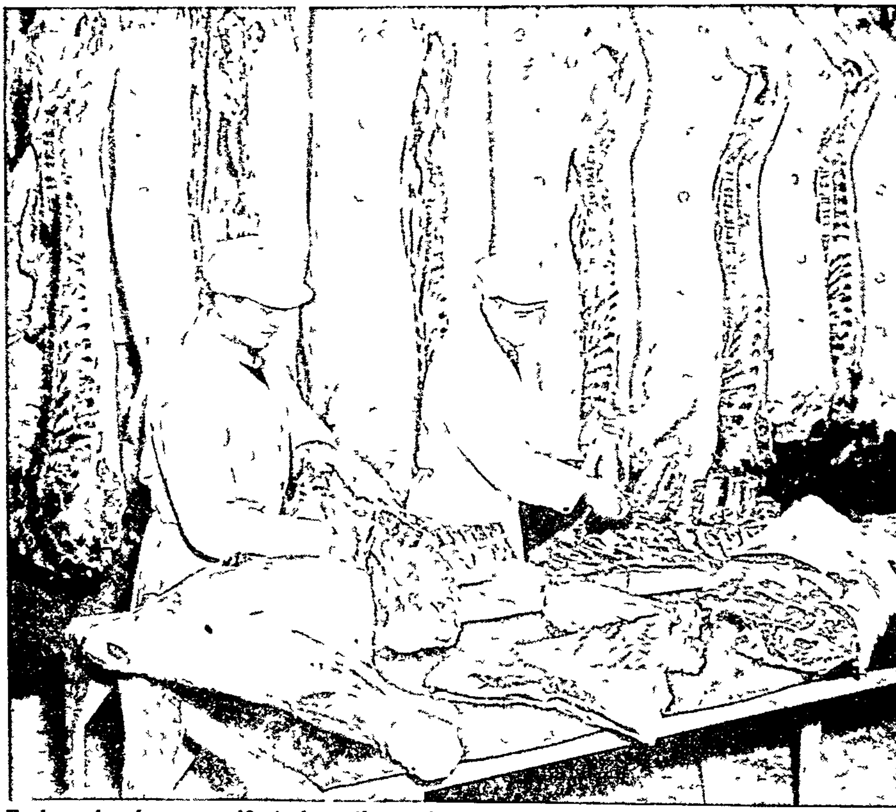
A government official in his clean white suit and apron is here giving the final inspection to the carcasses of hogs. Notice the electric lamp with the reflector attached to aid in the examination. All animals have four inspections. One of these takes place before it is slaughtered. After slaughtering there is a special examination of the throat glands, another of the internal organs, and then the final inspection here shown, in order to be sure that no diseased meat is sold.

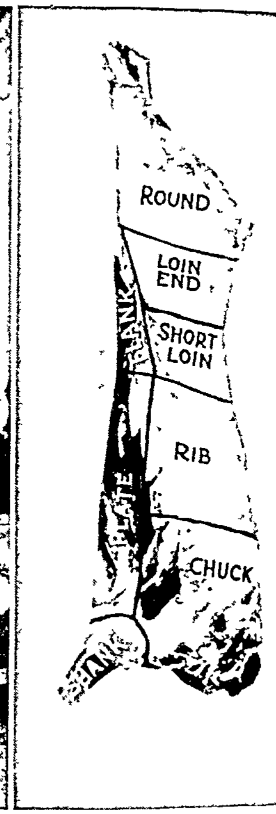
THE "SIDES" OF BEEF IN THE COOLER



After passing the various tests, the carcasses are carried along on trolleys into coolers like this. Each cooler is a great room that is kept at a temperature about six degrees above freezing. This temperature chills, but does not freeze the meat. From these coolers it is delivered to local dealers or shipped in refrigerator cars to coolers in branch houses owned by the packing companies throughout the country.

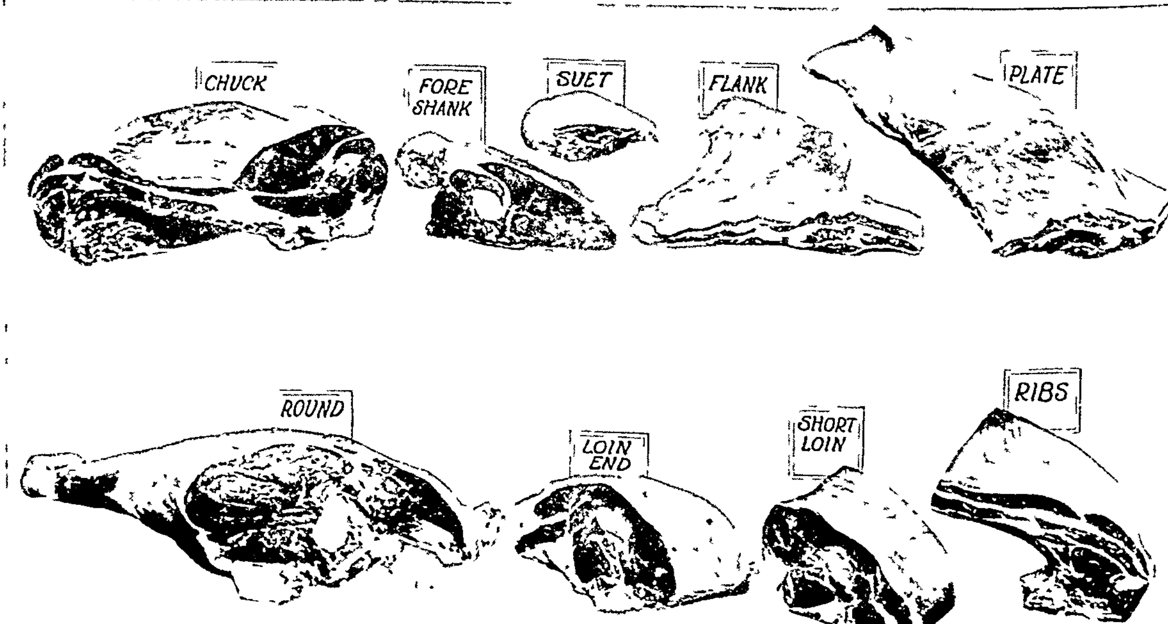
CUTTING BEEF IN A MODERN PACKING PLANT





Each worker has a specific task on the cutting tables of a modern meat-packing plant. The man at the left is removing the tenderloin from the loin. The man at the right is boning a plate for the restaurant and hotel trade. Notice the grade stamps on the hanging sides of beef. For the retail trade these sides are shipped out whole to retail stores. There the butchers cut off pieces as wanted by the customers.

THE VARIOUS CUTS OF BEEF



Everybody, of course, knows what part of the animal a round steak comes from, but do you know the other cuts? Here they are so that you can easily identify them in the butcher shop. On the right in the upper picture are shown the parts of the beef from which these cuts come. The end of the loin nearest the "round" gives sirloin steak, the middle portion tenderloin steak, and the rib end porterhouse. The real "tenderloin"—not the steak—grows inside the loin.

MECCA, SAUDI ARABIA. Birthplace of the prophet Mohammed, Mecca is the holy city of Mohammedanism, or Islam. Toward this city followers of Mohammed turn in prayer five times each day. To Mecca each year journey 100,000 to 200,000 Moslem pilgrims, for every devout Moslem hopes to make a pilgrimage to its shrines once in his lifetime. Because of the city's sacred character, people of other faiths are forbidden to enter its gates. (*See also* Mohammed.)

Mecca is also one of Saudi Arabia's two capitals. It lies in a valley amid the arid hills that rise from Arabia's Red Sea coast, 45 miles inland from Jidda, its port (*see* Arabia). Tall stone houses with shuttered balconies line the narrow streets. All roads lead to the Great Mosque. Here a vast courtyard holds the Kaaba, a cube-shaped stone sanctuary, and other Moslem shrines.

People from all the Islamic lands make up Mecca's population. They have been drawn here by the pilgrimage. Their chief occupation is trade—particularly furnishing supplies to pilgrims. The region is too dry to depend on agriculture. The city's water supply is piped from the mountains. In the nearby oases, springs provide enough moisture for raising dates and grain in irrigated plots. The farmers, however, cannot grow enough to feed the city's population and its hordes of pilgrims.

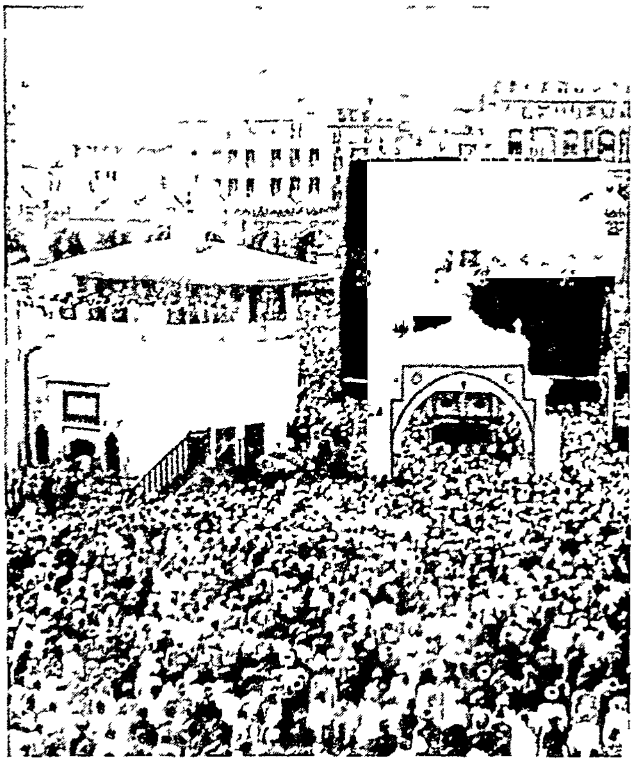
Pilgrims from Every Moslem Nation

In the twelfth month of the Mohammedan year, pilgrims converge on Mecca from every part of the Moslem world. Through the Suez Canal come the Egyptians bearing their gift of a costly black brocade veil (*kiswa*) for the sacred Kaaba. Through the Indian Ocean sail the faithful from Java, India, Pakistan, and Iran. Pilgrims from interior Africa take a series of boats and buses for a journey of many weeks. Wealthy pilgrims may make the journey to Jidda speedily by plane.

A few years ago camel caravans carried the pilgrim throng from Jidda to Mecca—a hot, two-day trip. Now most pilgrims crowd into buses and automobiles for a brief drive over a hard road. The poorer may ride in camel litters or make their way on foot. Before they reach Mecca, the pilgrim men shave their heads and put on the *ihram,* two white seamless garments. Women are covered from head to foot in a loose cloak and a veil.

On entering Mecca the pilgrim goes to the Great Mosque to begin the ceremonies of the pilgrimage. Reciting prayers, he kisses the sacred black stone in the southeast corner of the Kaaba and circles the building seven times—three times running and four times walking. He drinks from the sacred well of Zem-Zem and hurries seven times between hills called Safa and Marwah. On the ninth day he journeys to Mount Arafat where he takes his stand at noon and recites prayers and texts until sunset. At Mina, on the return from Arafat, he hurls stones at three pillars that represent devils and sacrifices an animal. He gives its meat to the needy of Mecca. After the sacrifice he again has his head shaved and dons his regular clothing. Now he is entitled to the coveted title of *Hajji* (pilgrim) and may wear a special turban.

PILGRIMS TO HOLY MECCA



The Moslem pilgrims gather about the Kaaba shrine in the courtyard of the Great Mosque. Here the Kaaba is covered with black brocade, usually brought from Cairo as a gift from the Prophet's Egyptian followers. All Moslems turn toward the Kaaba at prayer.

Traditions and History of the Pilgrimage

The ceremonies are based on ancient religious traditions. The Arabs trace their ancestry to the Old Testament patriarch Abraham and to his son Ishmael. According to legend, Ishmael had almost died in the desert when the angel Gabriel showed his mother, Hagar, the Zem-Zem well. The "running" from Safa to Marwah relives Hagar's frantic search for water. Abraham is believed to have built the first Kaaba after Gabriel brought him the black stone from heaven.

Mecca was a place of pilgrimage long before the birth of Mohammed in A.D. 570. It was an important commercial town on the ancient incense route from southern Arabia and the center of a religious cult. The Kaaba, with its black-stone fetish, was surrounded by 360 idols, one for each day of the ancient Arabian year. Mohammed abolished the worship of idols but made the pilgrimage even more important.

In the past a pilgrimage was beset with danger. Thousands might die from hardship, attack by bandits, or one of the epidemics that swept the multitudes. Today the Saudi Arabian government polices the route and takes sanitary measures to prevent epidemics.

Mecca, as capital of the vilayet of Hejaz, was under Turkish rule until the grand sherif of Mecca gained independence during World War I. In 1924 Ibn Saud and his Wahabi followers took the city, and it later became part of his kingdom of Saudi Arabia. Population (1948 est.), 80,000.

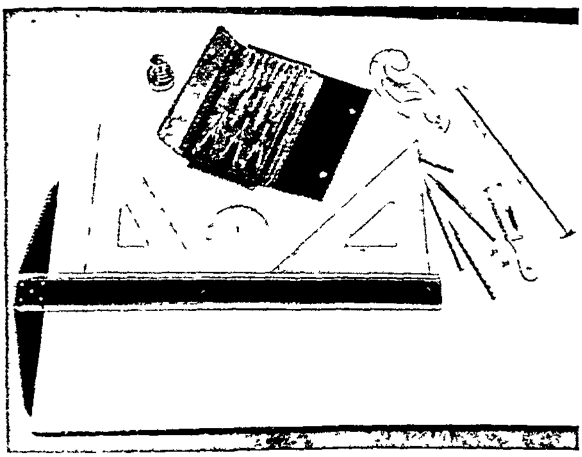
MECHANICAL DRAWING

—The Science That Builds on Paper

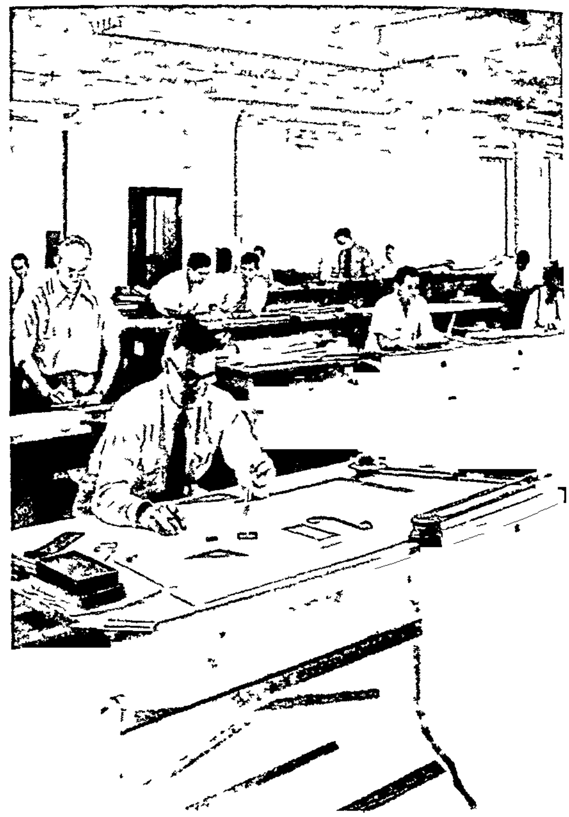
MECHANICAL DRAWING. Bridgebuilding begins long before ground is broken for the supports. The making of a bolt starts before the machinist sets an automatic machine to cut the thread in a piece of metal. Actually, in both projects, much planning and work have been completed before construction begins. In building a bridge, months of preliminary work are required before men and tools meet on the job.

All construction or manufacture, whether it is the Golden Gate Bridge or the smallest bolt, starts as an idea in a designer's mind. He estimates the shape and size of the object and puts the idea on paper as a rough sketch. However, sketches and estimates are not exact and may be misunderstood. Furthermore, an error of $\frac{1}{16}$ inch in a part of a high-speed machine can prevent the machine from working. The science of mechanical drawing was developed to eliminate these misunderstandings and errors.

Mechanical drawing, or drafting, is a method for showing a three-dimensional object on a two-dimensional piece of drawing paper. Mechanical drawings are a series of two-dimensional views. They give an exact representation of the object and show all parts in their true size relation. In this way a draftsman turns a rough sketch into a detailed drawing that everyone can understand in the same way. The drawings speak a universal language of lines and symbols.



FINE EQUIPMENT MAKES ACCURATE DRAWINGS
With a standard set of equipment, one can perform most drafting tasks on even very complicated drawings.



Many great building projects begin in modern, well-lighted drafting rooms. The draftsman uses special equipment such as this drafting machine to put ideas on paper.

Equipment and Instruments

Drafting is a task which demands skilled workmanship. The draftsman must be careful and patient. He must have the right tools to work with and a well-lighted working area. Such facilities help the draftsman to produce accurate and neat work. They also reduce strain and fatigue in the draftsman.

A standard set of drawing equipment should include the following items:

- Drawing board, drawing paper, and thumbtacks
- T-square
- 30°, 45°, and 60° plastic triangles
- Engineers' or architects' triangular ruler
- Metal or plastic protractor
- French curve
- Set of drawing instruments
- Ink lettering pens
- Drawing pencils with leads of varying hardness

The draftsman works on a table which can be tilted to any desired position. He makes pencil drawings on heavy white or cream paper, held on the inclined surface of the drawing board by thumbtacks or special tape. He then places a transparent paper called tracing paper over the completed pencil drawing. Following the pencil outlines, the draftsman neatly traces the drawing in ink on the tracing paper.

The drawing board is of soft wood, usually about 18 × 24 inches in size. It provides a smooth surface for drawing. The left edge of the board must be per-

fectly straight because it guides the T-square. Drawing paper should have a surface which will take pencil and India ink and which can be erased easily.

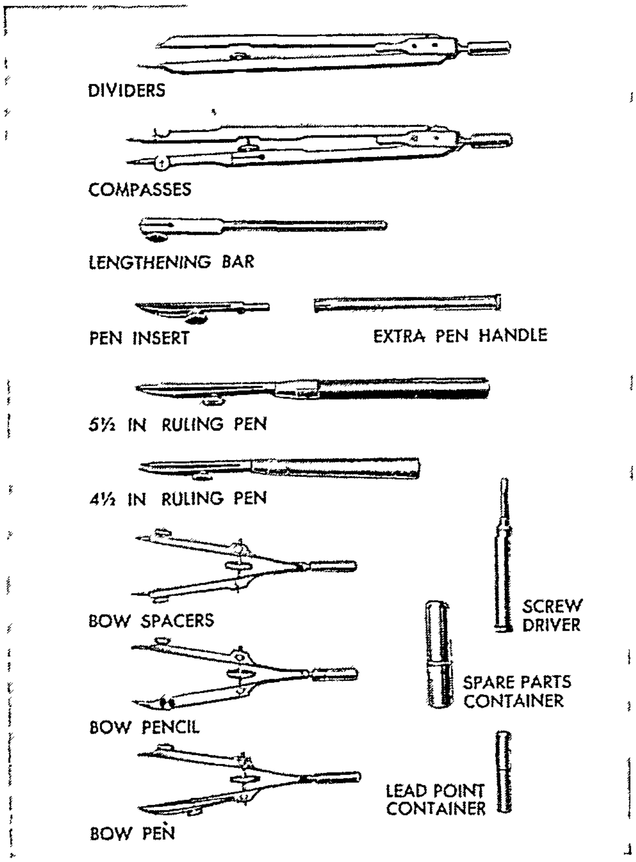
Many kinds of pencils are used. Symbols stamped on the pencils tell how hard the lead is. The pencil stamped 1H has the softest lead; the 6H pencil has the hardest. The 4H pencil is usually used for line drawing, but 5H and 6H pencils are sometimes used. The 1H, 2H, and 3H pencils are used for lettering and sketching. For making line drawings, the pencil should be sharpened first with a knife and then given a flat chisel-shaped point on a sandpaper pad. A cone-shaped point is best for sketching.

Straight Lines and How to Draw Them

The T-square is the work horse of mechanical drawing. It consists of a wooden blade with plastic edges that is securely fastened at right angles to a head. When drawing, the draftsman holds the edge of the head firmly against the left edge of the board, as shown in the pictures. In this position, the T-square is a guide for drawing horizontal lines. Parallel horizontal lines can be drawn by sliding the T-square up or down from the position used for the first line.

Two triangles are needed to draw vertical and inclined lines. One triangle has two 45° angles and one 90° angle. The second has one 30°, one 60°, and one 90° angle. Vertical lines are drawn with the triangle supported by the T-square as shown in the pictures on this page. Inclined lines, making angles of 15°, 30°, 45°, 60°, and 75° with the horizontal, are made in a similar way.

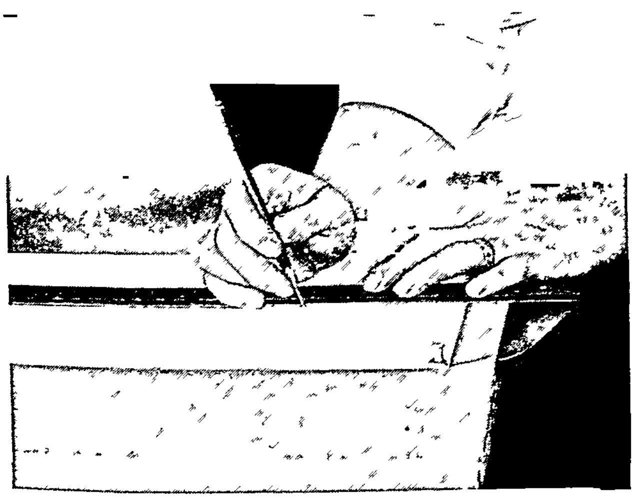
The protractor is used to form angles that cannot be made with the triangles. It is in the shape of a half-circle, with a mark at the center of the straight edge which is its diameter. Angles from 0° to 180° are marked on the semicircular edge. The draftsman aligns the straight edge with the base line for the angle. He places the midpoint at the spot from which the line forming the angle is to extend. He then draws a line from the midpoint of the straight edge to a point opposite the desired angle. This line makes the required angle with the horizontal.

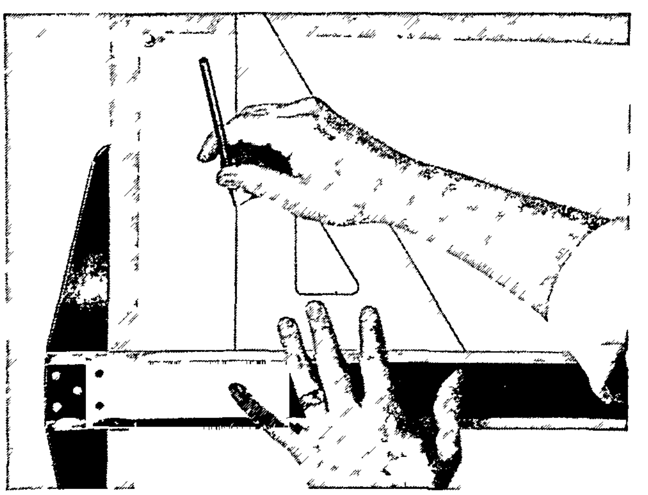


A SET OF MECHANICAL DRAWING INSTRUMENTS
Each instrument is built and used for its own special tasks. If used carefully, a good set can last a lifetime.

Scale Drawing and Measurement of Distances

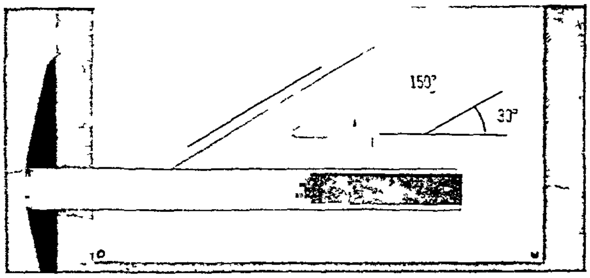
The engineers' or architects' ruler is actually much more than a ruler for measuring distances. Each of the three sides has two scales, making a total of six different scales. One scale is marked in inches and fractions of inches. The remaining five scales are



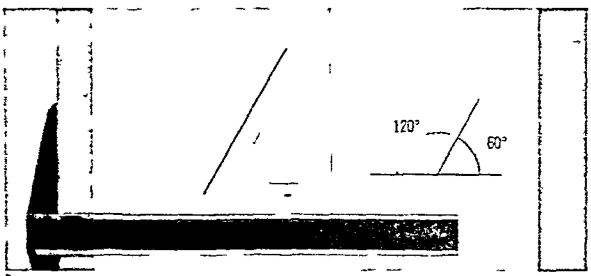


DRAWING STRAIGHT LINES WITH THE T-SQUARE AND TRIANGLE
In drawing horizontal lines, the T-square acts as a guide for the pencil. The left hand holds the T-square in place.
Vertical lines are drawn using the triangle edge as a guide. Triangle and T-square are held steady by the left hand.

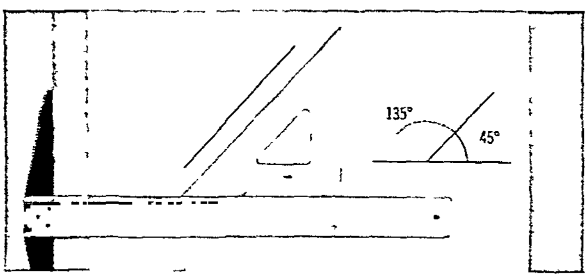
DRAWING LINES TO FORM ANGLES



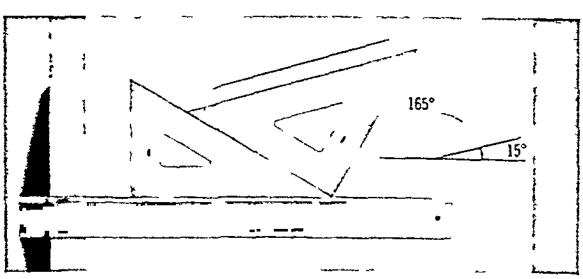
With the 30°-60° triangle in this position, a line drawn as shown makes an angle of 30° with the horizontal line.



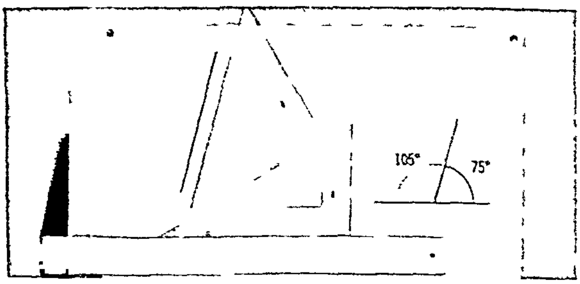
The same triangle is in a new position, and the line now makes an angle of 60° with the horizontal line.



When the 45° triangle is in this position, the line is drawn and makes an angle of 45° with the horizontal line.



By combining the two triangles, it is a simple task to draw a line making an angle of 15° with the horizontal line.



With this arrangement the draftsman can draw a line which makes an angle of 75° with the horizontal line.

marked in reduced ratios of the full length and are used to make reduced drawings. A drawing which is smaller than the object but made in exact proportion to the object is *drawn to scale.* Some commonly used standard scales are:

Full size: 12 inches on drawing = 12 inches on scale
½ size: 6 inches on drawing = 12 inches on scale
¼ size: 3 inches on drawing = 12 inches on scale
⅛ size: 1½ inches on drawing = 12 inches on scale

Instruments Used to Draw Curved Lines

Mechanical drawings are made up of combinations of straight lines and curved lines which show the edges and surfaces of an object. Straight lines can be drawn with the T-square, triangle, protractor, and scale. Curved lines must be drawn with special instruments

The large compass is used to draw circles or parts of circles, called arcs. This instrument is made of metal and is usually about six inches high. It has two legs which are joined at the top. These can be spread to the required distance at the bottom. One leg ends in a needle point and the other in a removable section that can hold a pencil or pen point. A lengthening bar can also be fitted to the compass for drawing very large circles. The needle point is fixed, and the compass is adjusted and used as shown in the pictures on the facing page.

The bow compasses are used in the same way as the compasses, but their use is limited to small circles and arcs. They are about four inches high and look like the compass except that they are adjusted to the desired radius with an adjusting screw. The correct way to set the radius and use the bow pencil is shown in the pictures (facing page). For small circles, the lengths of the points must be very carefully adjusted

Irregular curves (not circles or arcs) are drawn with special plastic instruments which are made in many different shapes. The most common of these instruments is called the French curve. It is used to connect irregularly distributed points to form a continuous curved line.

The French curve is fitted to a series of points plotted on the drawing and acts as a guide for the drawing pen or pencil. It is good practice to connect three points at one setting of the curve. The draftsman then moves the curve to the next position. If more than three points are connected at one time, an undesirable "break," or sharp corner, may be produced in the curving line.

Dividing and Transferring Distances

It is very often necessary to draw a line in one section of a drawing that is exactly as long as a second line in some other section. Thus the first line must be measured accurately and the length transferred to the second location. The dividers and bow spacers are the instruments which are used to do this work. The dividers look like the compass, except that both legs have needle points.

Dividers are often used to transfer a length from the architects' ruler to the drawing. The needle points

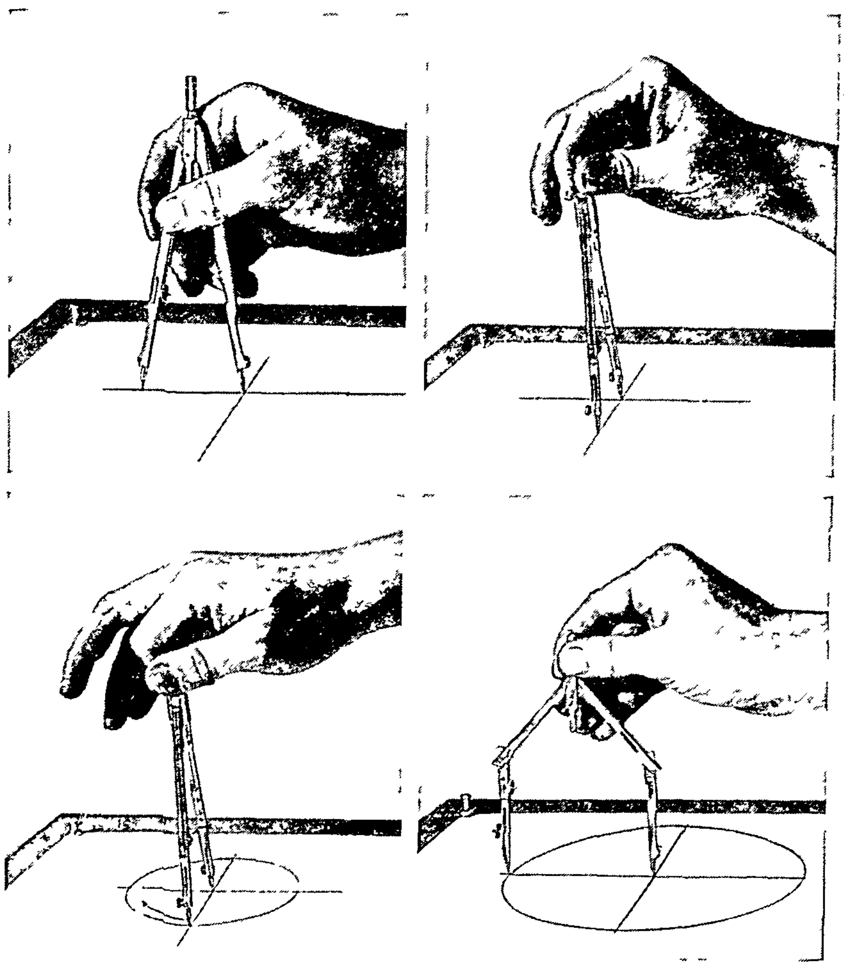
are adjusted to the distance by placing them on the correct scale dimensions. The draftsman then transfers the length to the drawing. Dividers are also used to divide a length into equal parts accurately, as shown on the following page.

When very small distances are to be transferred, the bow spacers are used. They look like the bow compass. Bow spacers are particularly good for small distances because the adjusting screw holds the distance steady when the points are placed on the paper.

Instruments for Drawing in Ink

All circular lines can be drawn in ink with the compasses or the bow instruments when they are fitted with the inking parts. The ruling pen is used for inking all other lines. This pen has two blades, or nibs, of equal length that form the point. The space between the nibs is filled with ink which flows from the point when it touches the paper. The size of the space can be changed by an adjusting screw. Thus, the pen can draw lines of any width from a thin 1/64 inch to a thick 3/16 inch.

The draftsman must be very careful when inking. He may have worked many days to complete an accurate, neat pencil drawing. Carelessness in inking can mar its appearance. Frequent mistakes may make it necessary to do the complete drawing over. The pen should be adjusted, filled, and used as shown on the following page.

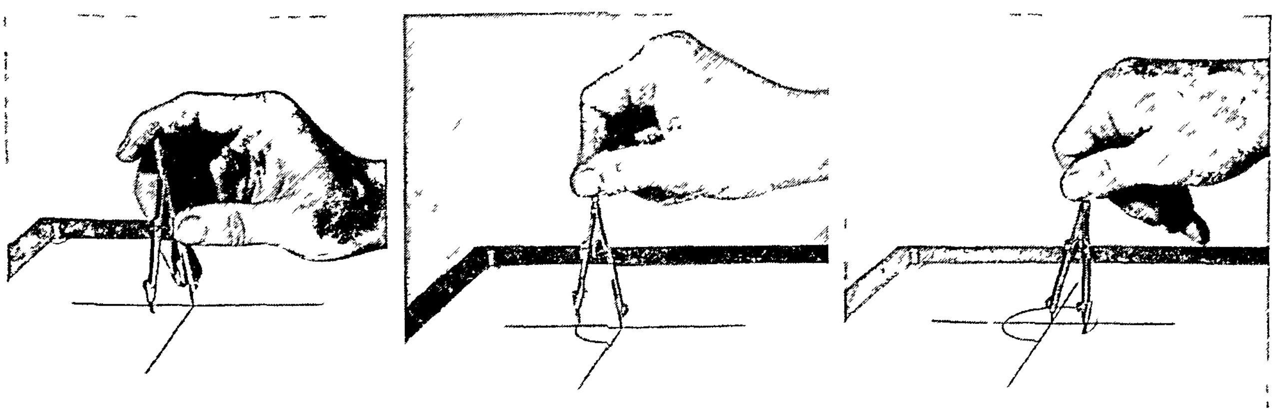


THE LARGE COMPASS IS USED TO DRAW CIRCLES

The compass is adjusted to the correct radius and guide marks are made. The circle is drawn by spinning the compass between thumb and forefinger. For inking, the legs are arranged so that the pen point is perpendicular to the paper.

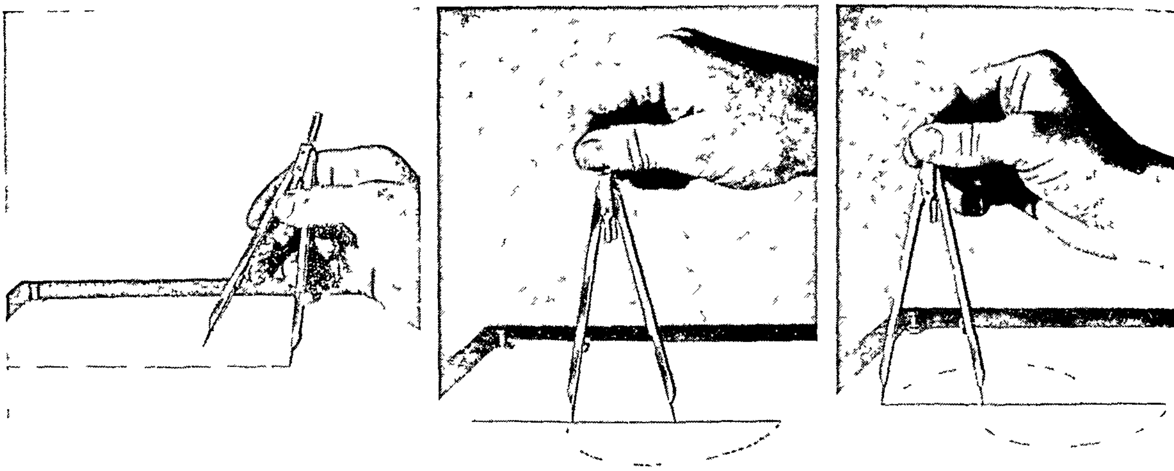
The Drafting Machine

The drafting machine is a mechanical drawing instrument used in many engineering offices and industrial drafting rooms. It combines the work of T-square, triangle, scale, and protractor. It acts as a guide and measure for all horizontal and vertical lines. A full-circle protractor built into the control head enables the draftsman to draw lines that form angles of any size. The machine is clamped to the drawing table and is controlled by the left hand. Interruptions are eliminated and time is saved because the right hand is completely free for drawing.



THE BOW COMPASS—AN INSTRUMENT FOR DRAWING SMALL CIRCLES

The needle point is set exactly at the intersection of the center lines, and the center screw is adjusted to the desired radius. The circle is drawn by spinning the bow pencil. The pencil and needle points must be very carefully adjusted.



HOW TO DIVIDE A LINE INTO THREE EQUAL PARTS

The needle point is set at one end of the line. The dividers' legs are opened to a distance about ⅓ of the length to be divided. Two half-circle rotations are made. The needle point now rests on the other end of the equally divided line.

The Importance of Lettering

A drawing which shows only the shape and size of a machine or structure does not completely describe the object. A finished drawing tells how the parts will be made, what materials will be used in manufacturing, and the tolerance or degree of error that will be permitted.

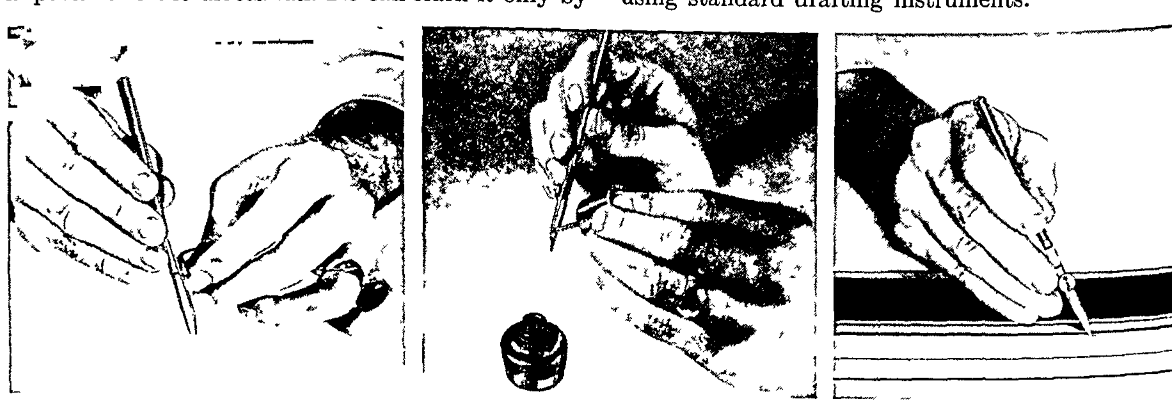
Information of this sort is lettered, or printed, on the drawing by the draftsman. A standard, easily read style of lettering is used by most draftsmen. It is called "single stroke commercial gothic." All letters and all numbers including fractions are lettered in this style. There are two variations, vertical and inclined. Schools and drafting departments usually use either one or the other. Examples of vertical lettering for capitals, lower-case letters, and fractions are shown on the facing page. The width and height of all letters, numbers, and symbols normally used follow standard rules. The standard method for lettering also describes the number of strokes and the order in which the strokes are drawn to make each letter.

The ability to letter swiftly and neatly is extremely important to the draftsman. He can learn it only by persistent and careful practice. To increase lettering speed, guidelines can be drawn with the triangles, or bow spacers, or with special lettering instruments. The order of strokes and proportions of letter sizes should be practiced with pencil before using pen and ink. Pen lettering is done with points that are specially made to draw the required width of stroke. Lettering guides such as the Leroy, Wrico, and Edco devices help produce straight, uniform lettering in standard sizes.

Developing Skill in Mechanical Drawing

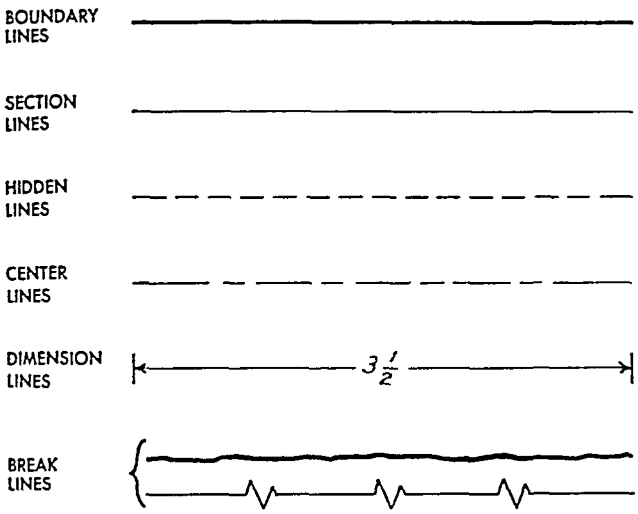
If a student wishes to become a skilled draftsman he must practice certain standard exercises. There are many kinds of exercises that can be performed to increase speed and develop accuracy. Drawing patterns such as the swastika, cross, and basket weave are helpful for learning straight-line techniques. Experience in drawing arcs and other geometric figures can be obtained from similar types of exercises

Mechanical drawing constantly involves the principles of plane and solid geometry. Geometry problems are valuable for experience and can be easily solved by using standard drafting instruments.



ADJUSTABLE RULING PEN DRAWS LINES OF MANY WIDTHS

The side screw is adjusted to provide the correct space between the nibs. This setting determines the width of the line. Ink is inserted into the pen to a height of usually not more than ¼ inch. Lines are drawn using the T-square as a guide.



THE DRAFTSMAN'S LANGUAGE OF LINES
Each line has a meaning. Consistent use of the correct lines avoids misunderstandings and reduces errors.

Describing a Shape by Orthographic Projection

An accurate mechanical drawing must do two things: it must show all lines, curves, and circles in their true length and in their exact relation to each other; and it must describe a three-dimensional object (length, width, and depth) in two dimensions (the drawing paper). The drawing should be complete and clear so that a workman can understand it and use it as a guide to make the object.

Three-dimensional objects are shown as a series of two-dimensional views. The object is drawn as seen from directly in front, from the side, and from the top. Each of these views shows two dimensions which are true and exact. Although these views are true, they may appear strange to a new student. Thus the cylinder in the picture on the following page appears as a circle when viewed from the top, but it has the outline of a square from the front. The three views together completely define the shapes of all parts of the object and show exact size relations. A perspective drawing creates the illusion of a solid object on flat paper. If examined carefully, however, it is seen that some lines and shapes do not appear as they actually are.

In the drawing, the front and side views are the same height. They are usually placed side by side. The greatest width of the top view equals the greatest width of the front view so it is usually placed directly above the front view in a drawing.

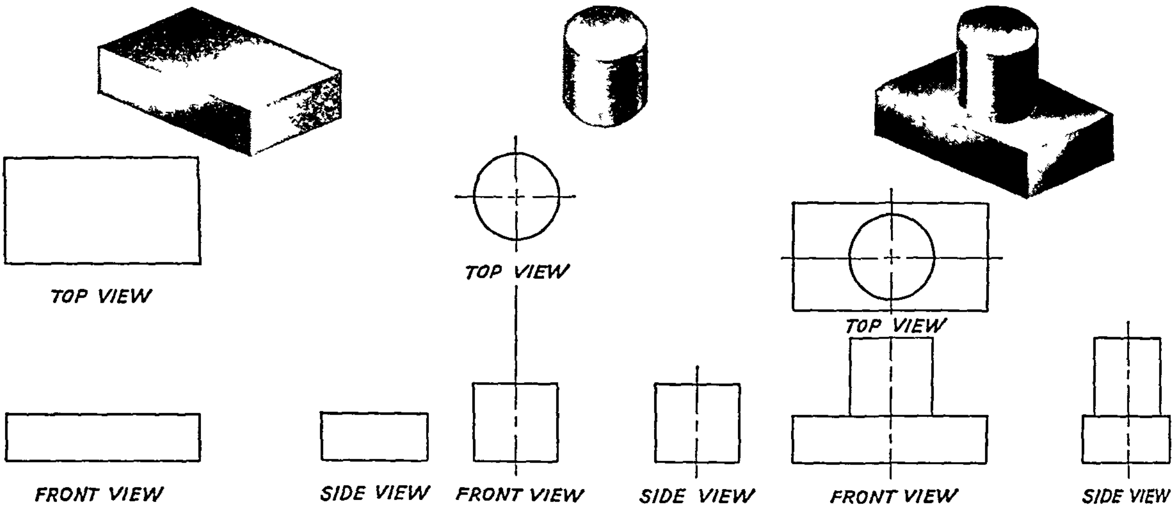
The principle of representing objects by different views is called *orthographic projection.* Several views are examined and drawn separately and then are located in positions so that the relations between them can be seen. In most drawings, three views are shown. Sometimes it may be necessary to show both side views. When a very complicated object is being drawn, five or even six views may be required to give a complete description of it.

Selection and Arrangement of the Views

Before starting a drawing, it is very important to make a careful study of all the surfaces, angles, and curves on the object. The draftsman must decide not only which views to show, but he also must select the "key" surfaces, lines, and intersections which will show the object's structure most clearly. The drawings of the trip lever on the following page are examples of how the professional draftsman does this job. Sometimes it is necessary to show internal parts of the object. These hidden lines and surfaces are shown by dotted lines.

It may be impossible to show clearly the interior structure of a complicated object. In such a case, a section drawing is made. The draftsman imagines that the object is sliced into two parts. He will then be able to show the interior by drawing the face, or

EXAMPLES OF VERTICAL LETTERING
Patient practice can produce lettering like these capitals, lower-case letters, and fractions. Guidelines and numbers indicate the direction and order of the strokes.



PERSPECTIVE DRAWING AND ORTHOGRAPHIC PROJECTION

These two methods of showing the same object are quite different. In perspective, the cylinder's top appears to be an ellipse but the "top view" shows it to be a circle, which it actually is. Mechanical drawing represents an object in its true shape.

sectional view, that would be exposed if the object were cut into parts.

Describing the Size of Objects

A drawing which shows only the shape of an object does not tell how it can be made. The size, or dimensions, of every part of the object must also appear. Information about size is supplied by dimensions and notes arranged on the drawing in a definite way.

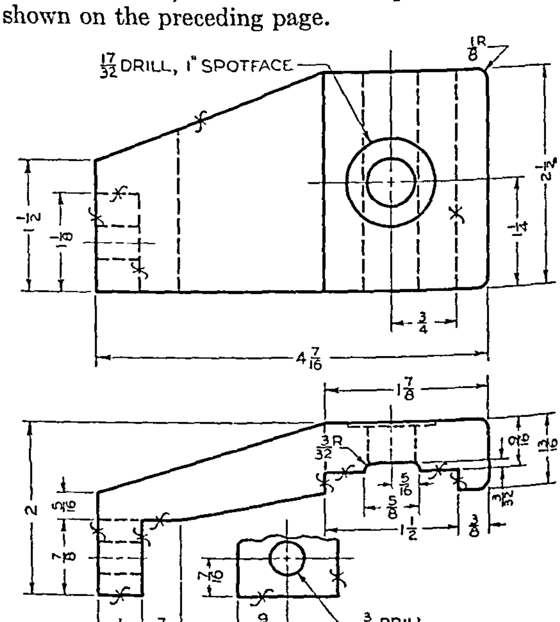
The drawing at the top of the facing page shows how and where dimensions are placed for clearness and accuracy. Conventional lines for dimensions are always drawn in one way. They are thinner than object lines and have an arrowhead at each end. A figure, located in the center of the dimension line, gives the actual length of the piece or part to be made from the drawing. When the dimension is placed outside the outline of the view, extension lines are drawn to show the points or surfaces measured on the object. Since extension lines are not part of the shape, they should not touch the outline.

Figures must be easily readable, but not so large as to overbalance the drawing. They are generally about ⅛ inch high. To avoid crowding, dimension lines should be ¼ inch or more from the boundary lines of the drawing and from each other. Correct placing of the dimensions can simplify reading of the drawing. In the *aligned* system, dimension numbers are placed in a position at right angles to the direction of the dimension lines. Thus, horizontal dimensions read from the bottom of the drawing, vertical dimensions from the right-hand side. Aircraft draftsmen use the *unidirectional* system of dimensions.

Inches are indicated by the symbol ″, and feet by ′. A dash is placed between feet and inches, for example, 6′-8½″. On machine drawings, detail dimensions up to 72 inches are given in inches. For greater dimensions, feet and inches are used. On architectural and structural drawings, dimensions of 12 inches and over are given in feet and inches. When all dimensions are in inches, the symbol ″ is omitted. A dimension in even feet is indicated as 7′-0″.

The Language of Mechanical Drawing

The variety of lines used in preparing a mechanical drawing is large, and each of them has its special meaning. Boundary lines outline the shape of an object and its parts. Section lines are used to show intersections and the outlines of shapes within the boundary lines. The central axes of an object are represented by the center lines. Break lines are used to indicate that the entire object is not seen in the drawing. These, together with hidden lines and dimension lines, are used most frequently. They are shown on the preceding page.



TYPICAL DRAWING OF A MECHANICAL PART

Top view, side view, and part of the front view of this trip lever supply all the necessary size details.

The Finished Drawing

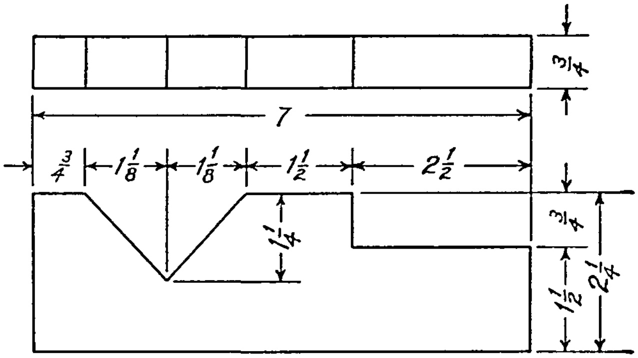
After the arrangement of views is planned, the draftsman prepares a full pencil drawing. First, the center, boundary, and section lines are drawn. Next the principal measurements are indicated. Circles, arcs, and rounded corners are then drawn. The dimension lines are added and all the dimensions are put in. The drawing is completed by lettering in the title block which identifies the object drawn, the draftsman, and the company. The drawing is checked by a superior to detect errors that may have been overlooked by the draftsman. All errors should be corrected before the drawing is inked. It is very difficult to erase inked lines or lettering neatly.

After errors are checked and corrected, the drawing is inked completely. A definite sequence in inking produces the best results. Center lines, small circles, large circles, irregular curves, the remaining straight lines, and dimensions are inked in that order.

Ink tracings of pencil drawings are often made on transparent tracing cloth. The inked drawing can then be reproduced in as many copies as needed. The copy is called a blueprint. It is made on chemically treated paper which reproduces the original drawing in the form of white lines on a blue background (*see* Blueprint). The methods and equipment for making blueprints have improved greatly in recent years. It is now possible to make satisfactory blueprints from pencil drawings, and many companies no longer require inked drawings.

Special Drafting Methods

Drafting is used by all industries which manufacture or build. Each industry requires special types of drawings to meet its own needs. Many special symbols and drafting conventions are used, but all are based on the same fundamental principles of orthographic projection.

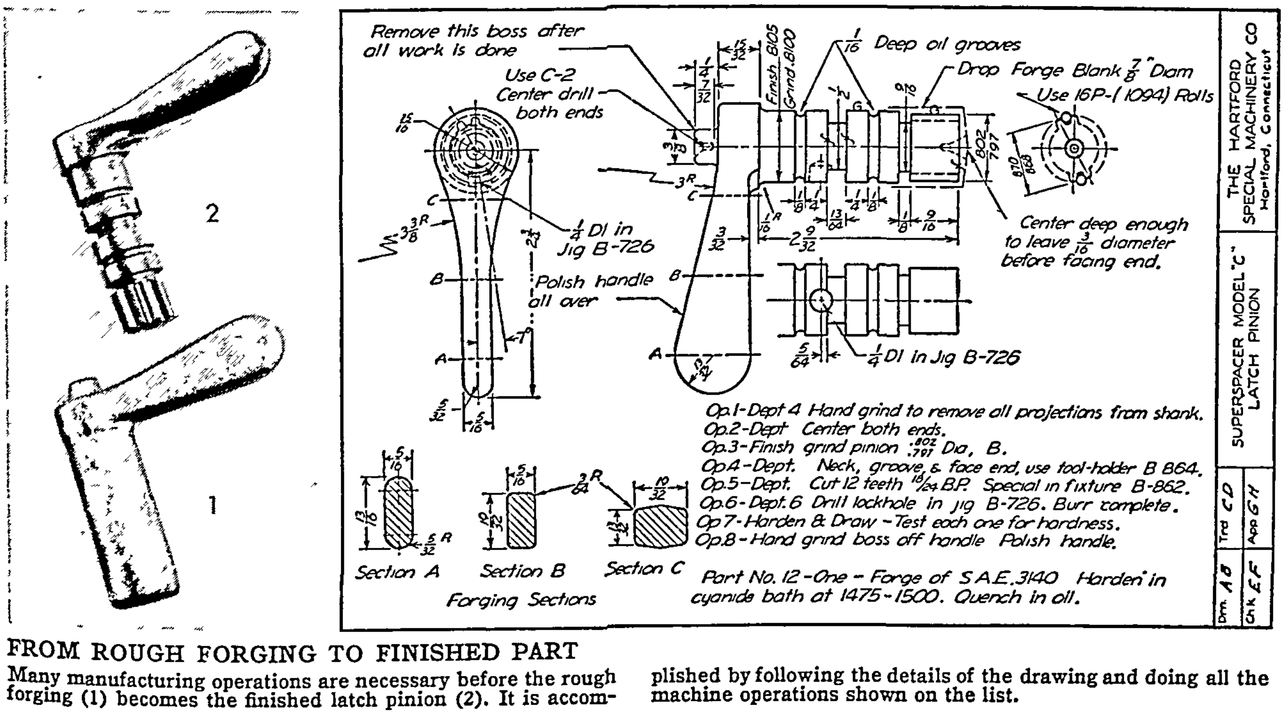


THE LOCATION OF DIMENSIONS
Correctly placed dimensions supply necessary information about the size relations of all parts of a drawing.

Welding is being used more and more in all mechanical and structural industries. A specialized type of drafting has been developed to show its applications. Ideographic, or picture-writing, symbols are used in welding drafting. They supply a simple method for giving the type, location, size of weld, and welding combinations for many manufacturing processes.

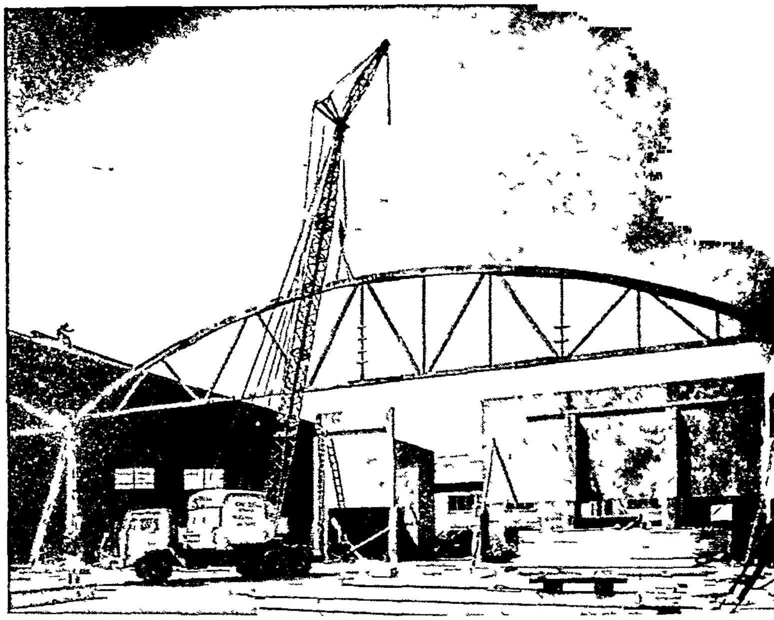
Sheet-metal drafting shows complex shapes that are formed by bending thin sheets of metal and fastening them with welds or rivets. These drawings must show the finished object and the shape of the flat metal sheet from which the object is formed.

Architectural plans are drawn to a small scale. Many special drafting conventions and symbols are needed to show the materials and appliance connections that are built into a structure. The architect's working blueprint includes plans, elevations, sections, and detail drawings. Together they make up a working guide for building the structure.



FROM ROUGH FORGING TO FINISHED PART
Many manufacturing operations are necessary before the rough forging (1) becomes the finished latch pinion (2). It is accomplished by following the details of the drawing and doing all the machine operations shown on the list.

The MECHANICS *of* BUILDINGS, MACHINES, *and* MOTIONS



In many structures the builders support the roof with trusses. One of them is being put in place here. Mechanics explains why this type of truss is built as it is

MECHANICS. A man can lift a 94-pound sack of cement fairly easily and even carry it. A strong man may push and tumble a rock weighing several hundred pounds across level ground. This is about the most a human being can do with his own strength.

With machinery and a motor or engine, however, men can move huge weights at high speed, even through the air. Without engines or motor power, men can still move great weights by using a few simple devices. They can pry up large stones and other heavy weights by using a crowbar as a lever and then can roll away the weight easily on wheels. With a jack a boy can lift the end of a motorcar.

In all these operations, even to the most complex power-driven machinery used in manufacturing, transportation, and construction, certain general principles, or "laws of nature," hold true. These principles make up the science of *mechanics*.

The principles of mechanics apply to all bodies in the universe from stars and planets to the tiny parts of an atom. They explain how an airplane flies and how a gyroscope behaves. Mechanics deals with the behavior of all kinds of matter under the influences of forces. The branch of mechanics which deals with bodies at rest is called *statics*, while that which deals with motion is called *dynamics*.

The Science of Keeping Objects in Place

Statics deals particularly with *preventing* undesired motion in structures such as buildings and bridges. These structures may seem motionless in their nature, but actually many forces act constantly to move them.

Basically, any structure must be able to stand up against the constant downward pull of gravity. At times, strong winds tend to push the structure over. Heat and cold make all parts expand and contract. People and loads shift about upon surfaces such as floors. Bridges must carry heavy, rapidly moving automobiles, trucks, and railroad trains. To offset these forces the designer must provide balancing forces strong enough to prevent too great a movement of any portion of the structure.

Ancient and Modern Bridging over Open Spaces

One means of solving many such problems is the arch. Since very early ancient times men have known how to use stone or brick arches for supporting weight above a passageway or other open spaces, or for building a bridge over a river. Accompanying pictures and a separate article explain the building principle used (*see* Arch).

Arches built of stone or brick have one weakness. The wedge-shaped stones or bricks could be pushed outward at or near the supports. Early builders prevented this by providing thick walls at the sides of the arch and supports or by bracing the sides with buttresses. (*See also* Architecture.)

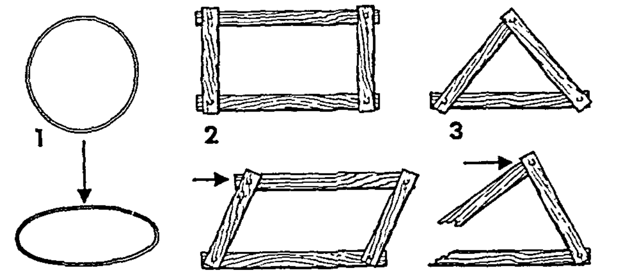
Modern builders make an arch strong by using one piece of reinforced concrete. They can also build more compact structures such as bridges by using latticework made of triangles, called a truss. Trusses are strong because triangles hold their shape firmly against bending, pulling, or pressing until the material of which they are made is broken (*see* Bridge).

Center of Gravity and Support

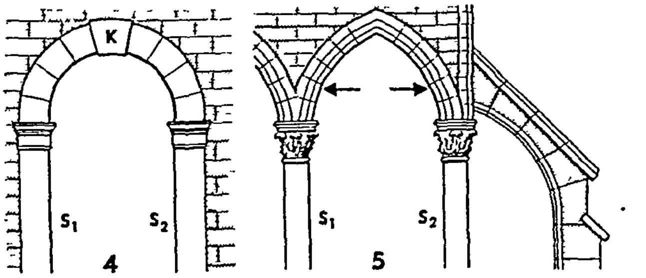
In many mechanical situations, the weight of any solid object can be considered as concentrated at one point, called the *center of gravity*. Once the center is known, the support given to it will tell how the object will respond to various forces.

The center will remain at rest when the downward pull of gravity upon it is matched by equal and opposite supporting (upward) force. This supporting force may be supplied from below by a foundation or

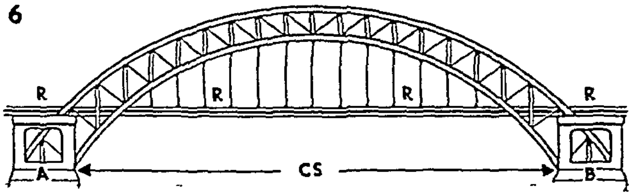
HOW BUILDERS ARRANGE TO SUPPORT WEIGHT OVER OPEN SPACES



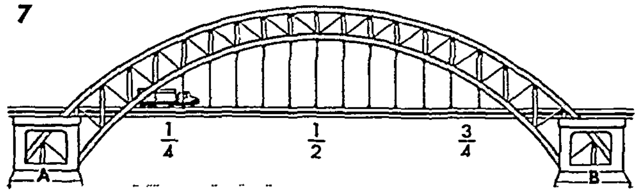
A truss uses triangular bracing because a triangle is the strongest structural form. A circular hoop can be flattened easily to an ellipse (1). A rectangle made with one nail at each corner can easily be pushed into another shape (2); but a triangle so made can be changed only by breaking the material (3).



In a stone arch (4) the keystone (K) and other members transfer weight to lower pieces of stone until all the weight rests upon the supports (S_1 and S_2). The thrusts upon these supports may push them sideways unless they are stiff and strong or are well braced by a side wall, or buttress, as in the pointed arch (5).



This bridge (6) combines two methods of supporting loads. An arch, made of triangular steel bracing, rests upon abutments (A and B) at the sides of the clear span (CS). The roadway (R, R, R, R) is carried upon the arch at either end and is hung from it between the abutments.



When a moving load is one fourth of the way across the bridge (7), abutment A supports three fourths of the moving weight, and B one fourth. At the halfway point, each abutment supports one half of the moving load. At the three fourths point, B supports three fourths and A one fourth.

from above by a cable or wire which holds the weight. The center can also be held by a supported axle which permits the body to turn.

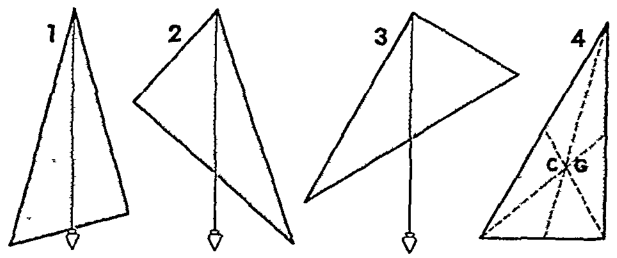
The result of combining forces can be learned from a diagram called a *parallelogram of forces*. The diagram shows how strong two supporting wires must be in order to hold up a bird feeder. This use of the diagram is called a *resolution* of forces because it proceeds from knowing what must be done (holding up the feeder) to telling how strong each supporting part must be. The same kind of diagram can be used for a *composition* of forces; that is, combining two or more forces acting in different directions to determine the combined effect (called a *resultant*).

Rotation and States of Equilibrium

Some forces tend to make an object's center of gravity move along some line. Others may be exerted along a line which does not pass through the center of gravity. Any such force tends to make a body rotate upon some axis. The force, multiplied by the distance between the line of the force and the axis, is called a *torque* (pronounced *tôrk*). A body cannot be completely at rest unless all torques, as well as forces which tend to move the center of gravity in some direction, are balanced.

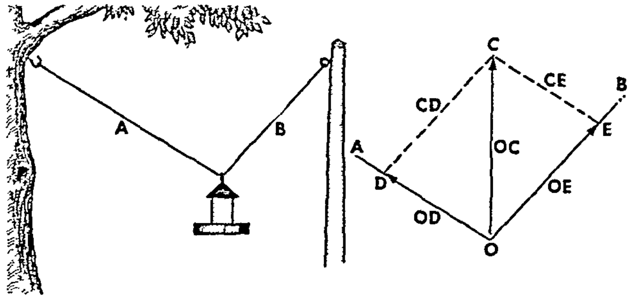
Once a complete balance exists, the body is said to be in *equilibrium*. (The word is from Latin terms that mean "equal balance.") The most basic problem in designing structures such as buildings and bridges is to provide a state of equilibrium for all parts of the structure. This state must take into account various changes in the forces. The direction and strength of wind pressure upon a bridge or building,

FINDING A CENTER OF GRAVITY



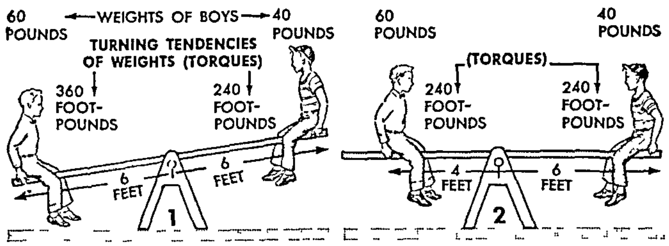
To find the center of gravity of a triangular figure, hang it from each corner in turn. Draw lines from each corner as shown by a cord and a weight (1, 2, 3). The three lines should meet in a point, the *center of gravity* (CG in 4), and the mass will be evenly distributed around this center. If the triangle is pivoted here, there will be no unbalanced pull of gravity to make it turn.

FINDING FORCES WITH A PARALLELOGRAM

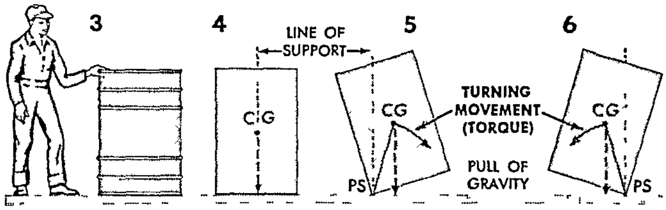


Here two wires (A and B) are holding up a bird feeder. However, the shorter wire (B) holds the larger share of the weight and has much greater *tension* in each portion of its length. To find the tensions, draw lines OA and OB parallel to the cables (right). The vertical line OC is the upward pull which holds the feeder. It is opposite to the downward pull of the weight. Lines CD and CE complete a parallelogram, and the lengths of sections OD and OE show exactly the tension in each wire.

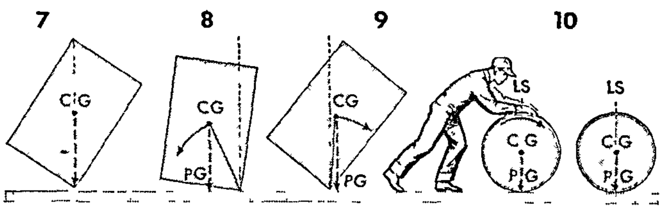
HOW OBJECTS MOVE IN RESPONSE TO TURNING FORCES



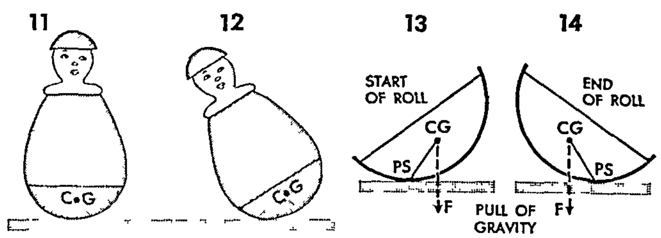
1. An upward supporting force holds the boys and the seesaw. But the heavier boy exerts a turning tendency (torque) of 360 foot-pounds (60 x 6) about the seesaw axis, while the lighter boy exerts only 240 pounds (40 x 6). Therefore the seesaw turns. 2. The heavier boy has moved toward the axis and reduced his torque to 240 foot-pounds (60 x 4). Now the torques are balanced, and the seesaw does not turn.



Before the workman starts to move the drum of chemicals (3), the center of gravity (CG) is firmly supported (4), and the drum is in *stable* equilibrium If tilted somewhat to either side (5 and 6), the pull of gravity upon point CG creates a torque, or turning force, around the new point of support (PS) and pulls the drum back to the stable position.



If the workman manages to balance the drum as shown (7), the drum is in *unstable* equilibrium Even a tiny displacement will create a torque (8 and 9) which will turn the drum farther from the unstable position. But if the workman *rolls* the drum (10) it stops without further turning wherever the force of pushing stops, because CG is always on the line of support. This is *neutral* equilibrium.



11. In an upright roly-poly the center of gravity (CG) in the weighted bottom is above the point of support. Tipping the roly-poly (12) shifts the center of gravity away from above the point of support. When the roly-poly is released, the *force* of gravity (F) acts on the *center* of gravity (CG) (13) and produces a torque which makes the toy roll from the point of support (PS). When it reaches the upright position, its inertia makes it roll too far. Then it rolls back (14), and finally it comes to rest standing upright.

for example, may change at any moment; and these forces can be more troublesome than weight.

Some disturbances may tend to move a structure in one direction, as when an earthquake shifts a building bodily. Most disturbing forces, however (such as change in pressure or direction of wind), produce a torque which tends to turn or tip over the body. What happens then depends upon the body's state of equilibrium when the disturbance occurs.

A body in equilibrium may be in any one of three states—*stable*, *unstable*, or *neutral*. It is in *stable* equilibrium if the force of gravity restores it to its original position, once the torque has disappeared. It is in *unstable* equilibrium if the force of gravity continues to turn it to a new position after the torque ceases to act. The body is in *neutral* equilibrium if it comes to rest wherever it may be, once the torque is removed.

Dynamics, the Science of Motion

When some force acting on a body is not balanced, the force produces a change in the motion of the body. (Since being "at rest" is "zero motion," setting a resting body into movement is "change of motion.") The principles of dynamics explain how the planets move through space, why a kicked football takes a certain path, and why a pitcher can make a baseball curve. Dynamics provides a foundation for developing rockets, guided missiles, and airplanes. An airplane autopilot utilizes the dynamics of gyroscopes. (*See also* Airplane; Gyroscope.)

How Simple Machines Aid Effort

Some applications of dynamics are extremely complicated, but many principles are clearly demonstrated in devices called *simple machines*. Among these machines are the lever, the wheel and axle, the inclined plane, and the screw. They are all used to do work; that is, to exert forces over certain distances to move weights or overcome resistances.

One great use of such machines enables a small force, such as a man's muscular power, to lift a large weight. A simple example is use of a stiff bar, called a *lever*, which rotates upon a fixed point, called a *fulcrum* (usually marked F in diagrams). Force is applied at some point (often called E for "effort") along the bar. At some other point (often called W for "weight" or R for "resistance"), the bar exerts force to move a weight or overcome a resistance. The distance E-F is called the *effort*, or *input*, arm, and the distance F-W is called the *weight*, *resistance*, or *output* arm.

What the lever will do depends first of all upon where E, F, and W may be along the bar. In the

first-class lever, the fulcrum is between points E and W. In *second-* and *third-class* levers points E and W are on the same side of the fulcrum. In the second class, W is between F and E. In the third class, E is between F and W.

The amount of weight a man can move depends upon the distance through which points E and W move in turning around the fulcrum. This fact can be stated as a law: *the force applied, multiplied by the distance through which it acts, is equal to the output force, multiplied by the distance moved.* This general statement, or principle, is called the *law of ideal machines.* (Actual machines suffer some losses, as explained later in this article.)

The law can be stated as a formula: $Ed_1 = Wd_2$. (E means "force applied"; d_1, "distance over which applied." W means "force output"; d_2, "distance over which the load was moved.") The actual movements in lever actions are portions of circles, made as a lever turns around its fulcrum; but the relative distances d_1 and d_2 can be judged from the lengths of the input and output arms. The formula as applied to levers is often called the *law of levers.*

The law can be applied with levers in various ways. Favorable ratios for lifting weights can be obtained from levers of the first and second classes, as shown in the diagrams. In each example the effort, or input, arm is longer than the resistance, or output, arm; and a small force moving through a certain distance will lift a large weight through a smaller distance. The ratio of the output force to the force applied (W/E) is called the *mechanical advantage* of the lever. (The law also applies to other machines which give mechanical advantage.)

A different mechanical advantage is given by a third-class lever, such as a man's forearm. Here the muscles can lift the forearm at their point of attachment only a short distance, whereas the full length of the forearm can lift a weight held in the hand a much greater distance. This also gives an advantage in speed of movement, since the weight is moved a greater distance than the point where the force is applied. To gain this double advantage the muscles must exert force correspondingly greater than the weight. The same advantage can be gained from a first-class lever by making the input, or effort, arm shorter than the output, or work, arm.

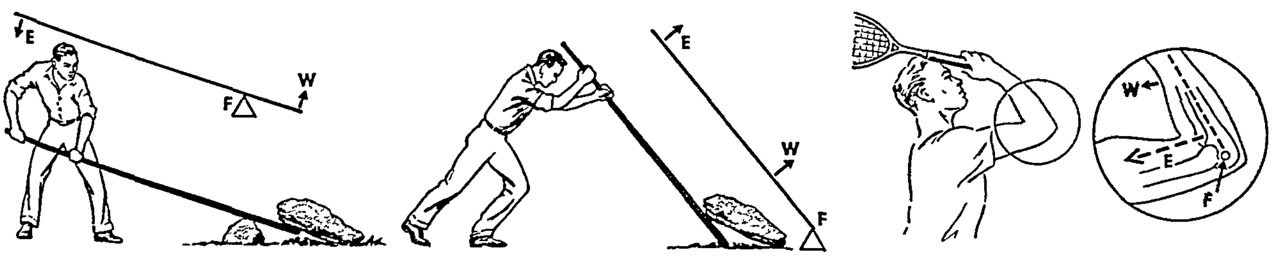
From these examples it is plain that no device operating according to the law of machines can "multiply effort," "save work," or "create energy." The machine can only transform an *input* of work or energy into an *output* exactly equal in amount. Only the characteristics, such as distances moved and forces applied and delivered in moving weight, can be changed.

Allowing for Frictional Losses

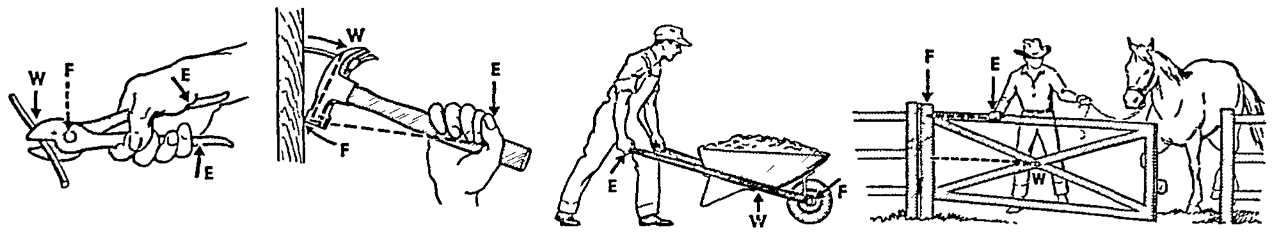
The law of machines never works out perfectly. One reason is that the weight of all parts of the machine itself must be moved. The energy needed for this is not available for the end load and must be subtracted from the results given by the law for an ideal machine.

The second reason is the need for overcoming *friction.* Friction is the resistance experienced by portions of matter which rub together or roll one over the other. Work must be used to overcome it and as a result becomes transformed into heat. This heat is considered a loss in the working of the machine, but the loss cannot be avoided. Without fric-

HOW LEVERS CHANGE EFFORT INTO MORE FORCE OR MORE MOTION

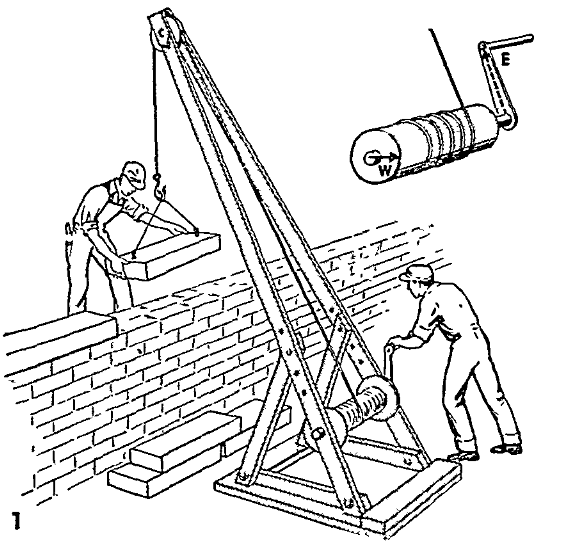


Men may start to move a heavy stone by supporting a crowbar on a hard object nearby and pressing down on one end to pry up the stone with the other. These are examples of first- and second-class levers. In each example, the effort, or input, arm (EF) is longer than the work, or output, arm (FW). Therefore, *less* effort over a certain distance moves more weight over a shorter distance. The *third-class* lever, shown by a human forearm, reverses this result. With it, *more* effort applied in the elbow joint is required to move *less* weight in the hand. But the arrangement increases the speed of the hand's movement and the distance moved. The enlargement shows how effort (E) is applied.

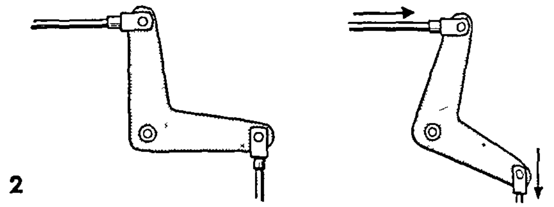


Lever principles are used constantly in work and everyday life. Wire cutters are *double* first-class levers. A claw hammer pulling a nail is a *bent* first-class lever. A workman uses a second-class lever to lift a load in a wheelbarrow. A person opening a gate uses a *double* (separate arm) third-class lever. For lever purposes, the weight is concentrated at the center of the gate. The letters E, F, and W indicate lever parts.

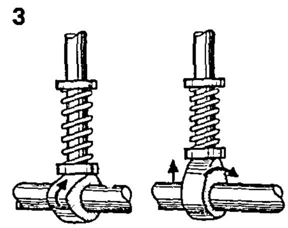
SPECIAL FORMS OF LEVERS—WHEEL AND AXLE, CAM, AND CRANK

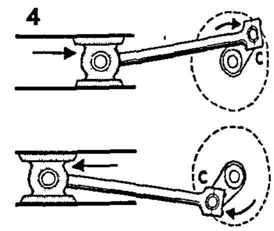


1. Here a stonemason is using a *windlass* to hoist a heavy weight with minimum effort. He turns a longer effort arm crank (E) and a shorter work arm (W) on the windlass, winds up the rope, and hoists the stone, as shown by the small diagram. But the mason must pay for the easy lifting of weight by making many turns of the crank.



2. Here a bent lever called a *bell crank* is used to transform *horizontal* (back-and-forth, or "reciprocating") motion to *vertical* (up-and-down) motion.





3. A projection called a *cam* on a rotating shaft operates a valve stem on an automobile engine. At one point in its turn the cam pushes up the valve stem. Once the cam passes *this point, the spring drives the stem down again.* 4. A lever called a *crank* (C) transforms reciprocating motion into circular motion of a wheel.

tion, working surfaces would slip, not grip. Friction can be lessened by oiling or greasing the working surfaces (*see* Friction; Lubricants).

Special Types of Levers and Other Devices

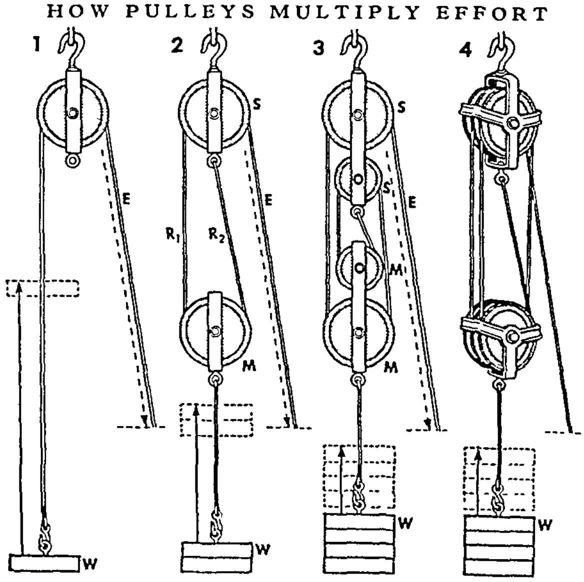
A wheel and axle has two lever arms, but each arm turns *continuously*. Thus an operator avoids having to reset a lever many times.

Pulling a rope over one fixed pulley merely changes direction of pull; the mechanical advantage is unity. A set of pulleys replaces lever arms with wheels, connecting them with a continuous cord or cable. Pulling on the free end of the cord amounts to operating the power arm of a lever; and the number of strands running through the moving pulleys determines the advantage obtained.

A locomotive pushing cars over a freight-yard hump shows the use of a simple inclined plane in lifting a weight according to the law of machines. Other common applications are in the courses followed by roads and railroads over heights of land. Often the course winds to give the advantage of an inclined plane instead of going straight up the height. Two planes used back to back to form a wedge show that the law of machines can apply to work other than lifting. A wedge can be used to overcome resistance other than weight, as in splitting a log.

A screw is an "inclined plane wrapped around a cylinder," as shown in the diagrams on the next page. It can be used to lift weights and also to overcome resistances. It can draw together the jaws of a vise, for example, and hold material tightly on a workbench. The law of machines cannot be applied readily to work done to overcome resistance. In the examples

HOW PULLEYS MULTIPLY EFFORT



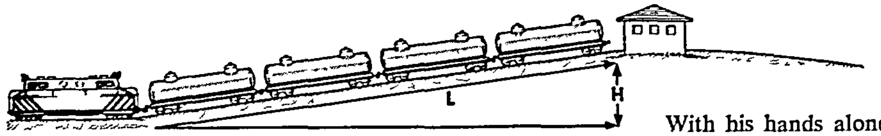
1. A pull at E passes over a single pulley wheel and lifts a weight (W). The pull must equal the weight. The only gain is a change in direction of movement.

2. A *moving* pulley (M) is added to the single pulley of diagram 1, and each strand of rope (R_1 and R_2) supports one half of the weight. Hence a pull of one half the weight applied at E and working over the standing pulley (S) will lift the moving pulley (M) and the weight. The pull must be exerted over twice the space the weight is lifted since each strand of rope (R_1 and R_2) must be shortened by the amount of the lift.

3. Here two standing pulleys and two moving ones are rigged with four strands of rope. Hence a pull (E) of one fourth the weight (W) will lift the weight. But the pull must move four times the distance the weight is lifted.

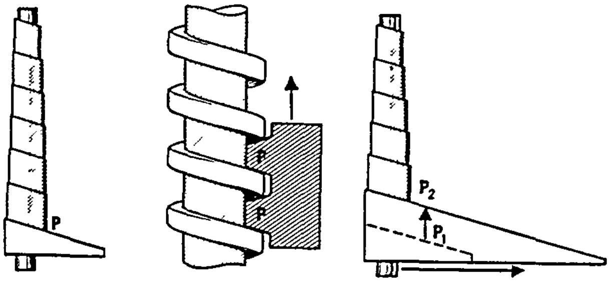
4. This diagram shows how the pulleys in diagram 3 are gathered into compact blocks in modern hoisting machinery.

THE INCLINED PLANE, THE WEDGE, AND THE SCREW

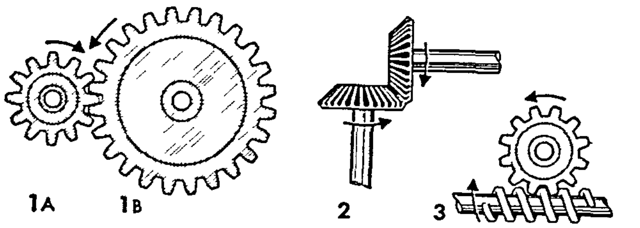


When a locomotive pushes cars to a hump in a freight yard, it uses an *inclined plane* to reduce the push needed to overcome the downward pull of gravity upon the cars. The push is spread over the length (L) of the incline, instead of being a lift through the height (H). The ratio of the length (L) to the height (H) is the mechanical advantage of the plane.

With his hands alone no man can tear apart a section of a log. By driving a wedge or an ax into the wood he splits it easily. Either tool is simply two inclined planes, placed back to back. The double mechanical advantage helps the workman to split the wood.



An inclined plane wrapped around a cylinder (left) amounts to a screw (center). As the screw turns, the "working edge" of its *thread* presses upon anything which rests against it. As a result, one turn of the screw amounts to "pulling the plane," shown at the left under point P, thereby lifting the point (right) from P_1 to P_2.



The gear at the left, 1A, has 12 teeth. With one turn it engages 12 teeth on gear 1B, which has 24 teeth. Therefore 1B makes only one half of a turn. In return for slower movement, however, gear 1B and axle exert twice the effort put into turning gear 1A. The ratio between numbers of teeth gives the mechanical advantage. Bevel gears (2) and a worm gear (3) are being used to turn a corner. In the worm gear a screw turns a gear.

described, for instance, the work consists of splitting wood fibers or holding material fast instead of moving weights; but if the resistances are measured in correct terms, the law holds good.

Inertia and Newton's Laws of Motion

Many problems in dynamics deal with bodies such as airplanes, bullets, and planets flying by themselves through space. Solutions for such problems are based upon Newton's three laws of motion.

The first law states a great fundamental property of matter called *inertia,* as follows:

1. Every body remains in a state of rest or of uniform motion (constant speed in a straight line) unless it is compelled by impressed forces to change that state.

Under this law a moving body is "at rest" as far as its own inertia is concerned, as long as its motion continues at the same speed and in the same direction. Therefore particles (or even worlds) of matter will keep flying through empty space forever, without being driven by any force, until something compels them to change their motion.

Newton's second law tells how a force compels a *change* of motion, at a rate of change called an *acceleration.* Newton stated the law as follows:

2. Change of motion is proportional to the impressed force and takes place in the direction of the straight line in which that force is impressed.

This law can be stated much more simply as a formula, using letters for force, mass, and acceleration: $F = ma$. The *wording* of the law, however, makes clear how an impressed force acts. The force does not necessarily compel the affected matter to set off in the direction in which the force is acting. It simply compels a *change* in the body's motion toward that direction.

Newton's third law is as follows:

3. Action and reaction are equal and opposite.

This law states a fact which can upset many calculations unless it is taken into account. It explains, for example, the saying that a man cannot lift himself by his bootstraps. Similarly, a man cannot lift himself by sitting in a chair and pulling *up* on the seat or rungs. As he pulls up on the chair, the effect reacts downward to the chair, and the chair pulls down on him. Action and reaction are equal and opposite. A striking modern example of action and reaction is jet propulsion (*see* Jet Propulsion; Rocket).

Mass, Force, and Acceleration

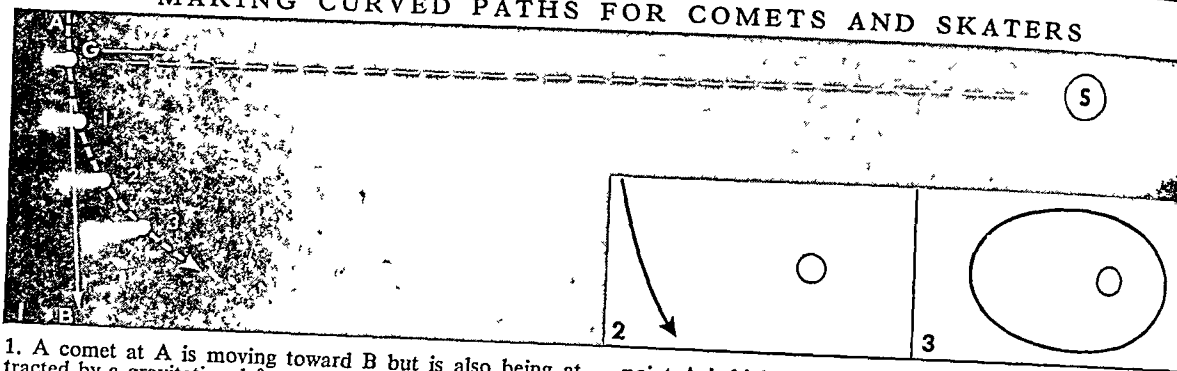
Newton's basis for mechanical calculations is the second law. Use of it requires exact understanding of the terms "mass" and "acceleration."

The *mass* of any body is the *amount of matter* it contains. Usually this is measured by weighing; but "weight" is not the same as "mass" because weight actually is the pull of gravity upon matter (*see* Gravitation). This difference can be visualized by considering a space ship on a voyage to the moon.

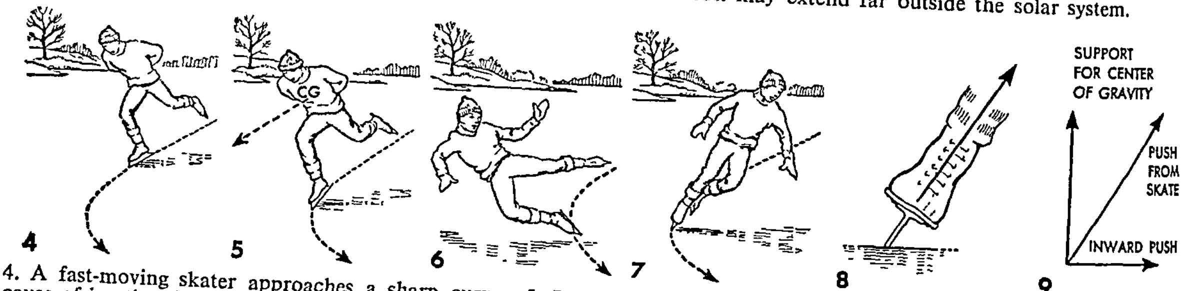
On the earth the ship's weight is fixed by the force of gravity pulling upon the ship's mass. As the ship moves toward the moon, at one point the forces of gravity exerted by the earth and by the moon are equal. Then the ship has no weight at all (except for pull from the sun and other planets). But the *mass* of the ship remains unchanged.

For a simple example of acceleration, suppose an automobile is moving 20 miles per hour at a certain

MAKING CURVED PATHS FOR COMETS AND SKATERS



1. A comet at A is moving toward B but is also being attracted by a gravitational force (G) exerted by the sun (S). If this force did not exist, the inertia of the comet would keep it moving with constant speed toward B. But the force G draws it from this path to point 1, then to points 2, 3, and so on, along a curved path. 2. If the comet's velocity at point A is high, the curve will be slight, and the comet will soon begin escaping from force G. It will fly on into outer space and never return. 3. If the comet's speed is not too great, however, the force G will hold it to an elliptical path, and the comet will fly along a huge orbit around the sun. The orbit may extend far outside the solar system.



4. A fast-moving skater approaches a sharp curve. 5. Because of inertia, his center of gravity (CG) will tend to keep going in the same direction and at the same speed. 6. Unless he counteracts this tendency, his inertia will tip him into a spill. 7. Here the skater avoids a spill by leaning inward as he enters the curve. 8. One edge of each skate bites into the ice with each stroke he takes, and the ice reacts by pushing him up as indicated. 9. Part of this push holds up his center of gravity as shown by the upright line. The other part is inward, toward the center of the curve, and changes his direction with each stroke. If he leans correctly, each inward push will help to take him smoothly around the curve.

instant, and a second later it is going 24 miles an hour in the same direction. During that second, it has received an *acceleration* of four miles per hour per second. A change in speed can consist of slowing, as well as speeding up. Physicists commonly call anything which reduces speed a *deceleration*.

Since inertia tends to keep bodies moving in the same *direction* as well as at the same speed, an acceleration is needed to compel change in direction. The compulsion may act continually, such as the pull of gravity, or it may simply be a constraint, such as a string tied to a stone. Whirling the string compels the stone to fly in a circle. The restraining force appears as tension in the string. (*See also* Centrifugal Force.)

Scientists take account of direction by using the word *velocity* to mean "a speed in a given direction." By this usage a speed counts only as distance covered in a second; direction does not matter. A velocity can change speed, direction, or both.

When a torque causes the rotation of a body upon an axis, the *rotational speed* (or *angular* velocity) is often measured in revolutions per minute. Very slow speeds may be measured in degrees per hour. For example, the earth rotates at an angular speed of one rotation a day or 15 degrees an hour.

A fundamental quality in dynamics is *momentum*. The momentum (M) of a body is the product of the mass (m) and the velocity (v) of the body. Thus $M=mv$. When a moving mass strikes another mass, the total momentum before and after the collision is exactly the same. This principle, the conservation of momentum, is a fundamental law of nature.

Another example in point is when a gun is fired. Before the firing there was no motion of bullet or gun, and the total momentum was zero. Firing gives the projectile a large momentum in one direction; and the conservation principle requires that the gun receive an equal and opposite momentum. The equal *and opposite* momenta of the gun and the projectile add to zero, as before firing.

Force, Work, and Energy

When a force makes a body move, the product of the force times the distance through which the force acts is called the *work* done by the force. Although the word "work" has many common meanings, physicists always use it with restricted meaning.

The work done on the body goes into increasing its speed, and the body in turn has the ability to do work by virtue of its motion. The capacity to do work is called *energy*. Energy associated with motion is called *kinetic energy*. The kinetic energy of a body is equal to one half the product of its mass times the square of its velocity ($KE=\frac{1}{2}mv^2$). Energy may have many forms in addition to the kinetic kind. (*See also* Energy; Power.)

MEDES. In the long-ago days when the mighty Assyrian Empire was at the height of its power, there grew up on its borders, in the mountainous land southeast of the Caspian Sea, another power which steadily became more dangerous—the kingdom of Media. In contrast to the Assyrians, who were Semites, the Medes belonged to the great Indo-European family, from which descended also most of the peoples of western Europe.

Once tributary to the Assyrians, these people, simple in their habits and strong in body, had won their independence and were gaining in strength, while their former masters became weakened through wealth and luxury. At length the Medes in 606 B.C. swept down from their heights on Nineveh, the Assyrian capital, laid that splendid city in ruins, and overthrew the Assyrian Empire.

For a brief time the Medes were the greatest power in western Asia. But among their vassals were the Persians, another Indo-European people, who were, like the Medes, followers of the religion of Zoroaster and similar to them in language and customs. And now again the subject state became the ruler, for Cyrus the Great, king of Persia, about 558 B C. seized the throne of the Median king Astyages. In time the two peoples were merged into one and history tells us no more of the Medes as a separate people, but of "the Medes and Persians." (*See* Persian History.)

TWO MEDICI RULERS

The painting of Cosimo, top (now in Pitti Palace), is by Angelo Bronzino. The one of Lorenzo, at the bottom (now in Uffizi Palace), is by Giorgio Vasari.

MEDICI (*mĕd'ĭ-chĭ*). In the stirring days of the Renaissance many families rose to princely power over Italian cities by force of arms, intrigue, and assassination, and their heads ruled as undisguised despots. The Medici of Florence, on the other hand, the most eminent of all in their princely patronage of art and literature, rose chiefly by their wealth derived from commerce and banking and for a century concealed their absolute rule under the popular forms of a republic.

Giovanni de' Medici (died 1429) was the real founder of the wealth and power of the family. His son Cosimo (1389–1464) did a vast banking and commercial business by means of his branch houses in Rome, Venice, Geneva, Bruges, London and elsewhere; at the same time he ruled Florence through his skill in securing the election of his own creatures to the chief offices in the city. His position was not unlike that of an American party boss, who corruptly rules a city or state by all sorts of underhanded tricks and favors, without ever himself taking office. But Cosimo was a generous patron of art and literature and his palace became an asylum for Greek scholars exiled by the fall of Constantinople in 1453.

With Cosimo's grandson Lorenzo the Magnificent (1449-1492), the glory of the Medici reached its height. He escaped the fate of his younger brother Giuliano, who was stabbed to death at high mass in a church as the result of a plot of their Florentine enemies, to which Pope Sixtus IV was also a party (1478). Lorenzo continued his father's policy of disguised rule, and even excelled him in the magnificence of his patronage of men of letters and artists, including the youthful Michelangelo. Lorenzo himself was a man of learning and a poet of real originality, but his verses were often scandalous in their subjects. He was also the wisest statesman among Italian princes of his day.

Lorenzo's influence at Rome enabled him to secure the election as cardinal, at the early age of 13, of his second son Giovanni. Later this son became pope as Leo X (1513–1521), and gained fame as one of the most liberal popes in the patronage of the fine arts; in Leo's day, also, began Luther's revolt in Germany. Leo's cousin Giulio, with whom he was reared in Florence, also became pope a little later, as Clement VII (1523–1534).

The later Medici (after 1531) abandoned the forms of a republic at Florence and assumed the title of Duke of Florence. In 1537 Cosimo the Great succeeded to the duchy, annexed Siena to his domains, and received from Pope Pius V the title of Grand Duke of Tuscany. The Medici continued to rule under this title until 1737, when the family became extinct.

Catherine de' Medici (1519–1589), great-granddaughter of Lorenzo the Magnificent, became the wife of one French king (Henry II) and the mother of three others—Francis II, Charles IX, and Henry III. She was ambitious to keep undiminished for her sons the power of the French monarchy. France was torn by religious wars and in the minority of her sons Catherine intrigued now with the Catholic party, now with the Huguenots, and was chiefly responsible for the terrible St. Bartholomew's massacre of Aug. 24, 1572. (*See* Coligny, Gaspard de.)

HELPING *the* BODY *to Overcome* DISEASE

MEDICINE AND SURGERY. The first duty of doctors is to care for the sick. To discharge this and other duties, the United States has about 200,000 licensed physicians, or approximately one for every 750 persons. This is the most favorable ratio of doctors to population that exists in any country.

In addition to treating the sick, modern doctors work to help keep people well. Diet, sanitation, housing, recreation, and family relationships are some of the factors they consider. Thousands of doctors engage in public health work. They inspect water supply and food and sources of food to prevent contamination and infection. A major duty is prevention or suppression of epidemics of communicable disease. (*See also* Health Department.)

Thousands of other doctors engage in special work which helps those who actually treat the sick. Many work in laboratories, making tests which reveal the nature of an illness and point the way to helpful treatment. Others spend their lives in research. Many work as professors and instructors in medical schools. Altogether, from 25,000 to 30,000 licensed physicians in the United States work in public health or special activities other than treating the sick.

The General Practitioner or "Family Doctor"

Advances in science and medical knowledge require many specialists. But the backbone of medical care is still the *general practitioner*—often called the "family doctor." About 85,000 of the physicians in the United States are in general practise.

In or near centers where specialists are available, the family doctor may send his more complicated or difficult cases to the specialists. In small towns and rural areas, he may be called upon to do anything from minor treatments to handling life-or-death emergencies. He may or may not have the services of a hospital close at hand. But in large towns or small, he has the priceless advantage of knowing his regular patients as *people* and not just as *cases*. He knows their temperaments and family circumstances and how these may affect health and help or hinder in treating illness.

The family doctor is called a general practitioner because he uses all branches of the healing art. He uses medicines of all types. He also works by hand, as when he sets a dislocated shoulder and uses instruments for operations. These "treatments by hand" (as contrasted with treatments by medicine) make up the work of a *surgeon*. In addition, the family doctor pays attention to general care—diet, the state of mind and habits of his patients, and nursing as it may be needed.

Modern Advances in Medical Treatment

Before the 19th century, knowledge of medicines was largely *empirical* (the result of experience). Doctors knew that certain substances and preparations were helpful in treating disease, but as a rule they did not know why. A few remedies, called *specifics*, had marked value for particular diseases or disorders. Among them were quinine for malaria and digitalis for heart ailments.

During all this time, doctors were limited to empirical medicines because they knew very little about the causes of disease. During the 19th century, however, scientists began making revolutionary advances in this field. (*See* Disease; and the section on the history of medicine later in this article.) As understanding of disease advanced, scientists and doctors developed many specific remedies. Among them were antitoxins and serums for preventing or curing infectious diseases (*see* Antitoxins; Serum Therapy). Medical scientists learned how to obtain and use vitamins for overcoming many deficiency diseases and how to treat glandular disorders with gland extracts and by other means (*see* Hormones).

Modern Specialties in Medical Treatment

These developments created many specialties in the field of medicine. The most general specialty is called *internal medicine*. One of the most important duties of an internist is *diagnosis*. This means accurate identification of what is causing a patient's illness. In obscure or complicated cases, painstaking and highly skilled tests are sometimes necessary to establish a diagnosis.

Many internists give treatment after diagnosis. But they may refer difficult cases to specialists in treating the diagnosed cause of illness. Among such specialists are *endocrinologists*, who treat glandular disorders, and *allergists*, who treat disorders caused by the intrusion of a foreign protein, such as pollen, into the human body (*see* Allergy).

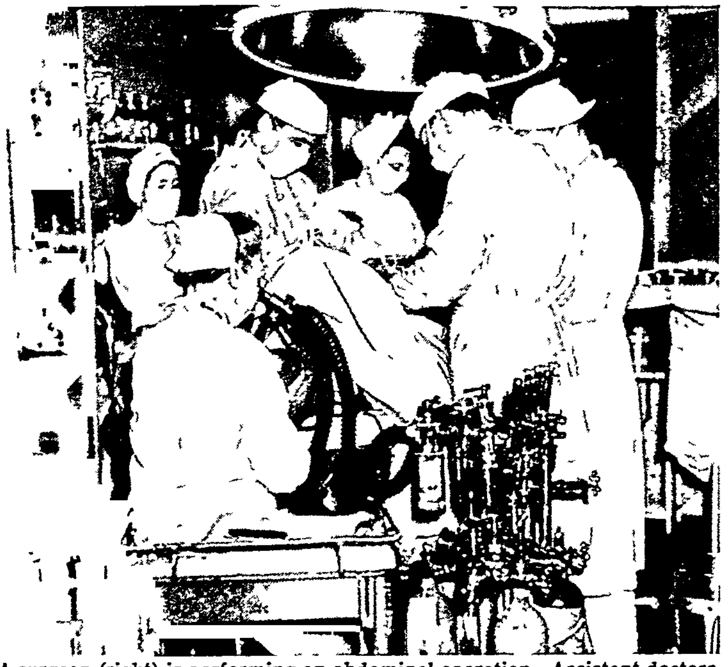
Various Specialties in Surgery

Before the 19th century, surgeons were limited largely to dealing with wounds and injuries, especially those received in war. They had no anesthetics or antiseptics, and so could not undertake lengthy operations. But during the 19th century these invaluable aids were developed, and they brought an era of phenomenal advance in surgery. Soon the knowledge and skill required for all but the simplest operations not only made surgery a specialty; it created a multitude of specialties within the field. The specialist may perform the same operation hundreds of times, and thus he develops skills and procedures far beyond those of any less practised man.

The largest group of specialists consists of general surgeons. A general surgeon performs many kinds of operations; but much of his work is within the abdominal region of the body, that is, with the digestive organs—stomach, intestines, appendix, liver, and gall bladder. The general surgeon may also treat the kidneys and the bladder, but this type of work is a specialty in itself, called *urology*.

A general surgeon may often treat injured or diseased bones. But this type of work is also a specialty, called *orthopedics*. Included in it is the exacting work of correcting deformities. Other specialties include surgery of the lungs and chest, the blood vessels and

SKILLED TEAMWORK IN MODERN SURGERY



A surgeon (right) is performing an abdominal operation. Assistant doctors and nurses help with the details. An anesthetist (seated with apparatus) keeps the patient unconscious and watches his general condition. All wear sterilized gowns, caps, and masks to guard against infecting the wound.

heart, and the nerves and brain. *Plastic* surgeons treat soft tissues, especially of the face, to repair damage caused by accident or to improve appearance. *Oral* surgeons treat diseases and injuries of the mouth, teeth, jaw, and adjoining tissues.

Specialties That Combine Medicine and Surgery

Many specialists combine medicine and surgery in their work. One of the largest groups of this type treats ailments of the ear, nose, and throat.

An important group of specialties is concerned with care of expectant mothers, childbirth, care of infants, and treatment of diseases peculiar to women. The field directly concerned with childbirth is *obstetrics*. The obstetrician begins his work months before the baby is to be born, with care designed to have both the mother and the baby in the best possible health at the time of the birth. For the actual birth he usually places the mother in a hospital. There he has an aseptic delivery room, help from expert obstetrical nurses, anesthetics, and the equipment needed to deal with any abnormal or unexpected difficulty.

The treatment of conditions peculiar to women is called *gynecology*. The care of infants and young children is called *pediatrics*. More than most other doctors, the pediatrician deals with patients who are well, rather than sick. He prescribes diet, and keeps common infections and digestive upsets from becoming serious. Pediatricians also act increasingly as advisers to mothers in their task of helping the child to develop normally in mind and character.

Treatment of Mental Illness

From early times, men have recognized mental troubles, ranging from persistent irritability and depressing fears to outright insanity. But until very recent times, these troubles were thought to be peculiar to the mind and character. A great modern advance has been the recognition of the fact that mental derangements are illnesses, like those of the body.

The medical specialty that deals with mental illness is *psychiatry*. Psychiatrists have developed helpful or curative procedures for many grave conditions and hope to overcome others. Considerable progress has also been made in dealing with mental troubles (broadly called *neuroses*) which fall short of being derangements or insanities.

This work recognizes that in many ways mind and body are one. Physical condition can have profound effects upon mentality and character; so likewise can the mental state cause important physical changes. When a person is driven beyond endurance by fears, resentments, or inner conflicts, the body may seek to secure relief for the mind by presenting the symptoms of a disease, without the person realizing what is happening. Doctors must be particularly careful in recognizing such *psychosomatic* ("mind-body") cases. With this in mind, an internist once said in a lecture: "When a patient complains of digestive upset, I always study his job and family as well as his stomach." (*See also* Psychology.)

Hospitals, Laboratories, and Clinics

Many tests and costly equipment are needed for modern medicine. Few doctors can afford to have all the equipment necessary, even for one branch of practise. Doctors prefer therefore to treat serious cases in hospitals, where the proper equipment and help are available (*see* Hospitals). Doctors also use public and private laboratories, which make tests for the profession.

Another development which cuts cost while improving service to patients is a coöperative type of clinic. Formerly the word "clinic" meant a division of a hospital or a medical school which gave free treatment to the poor, both as a duty and to give student doctors an opportunity to practise under supervision by older men. Such free clinics are still maintained by these institutions and also by public health authorities.

Today, however, some clinics are coöperative institutions maintained by a group of doctors to provide equipment and special services for the group. In some of them the doctors share expenses and have their own patients. In others the clinic is in charge of all treatments. After an illness has been diagnosed, the patient is treated by the doctor or doctors who can do the best for him. Patients pay the clinic, and the doctors receive salaries. Many medical centers use this plan.

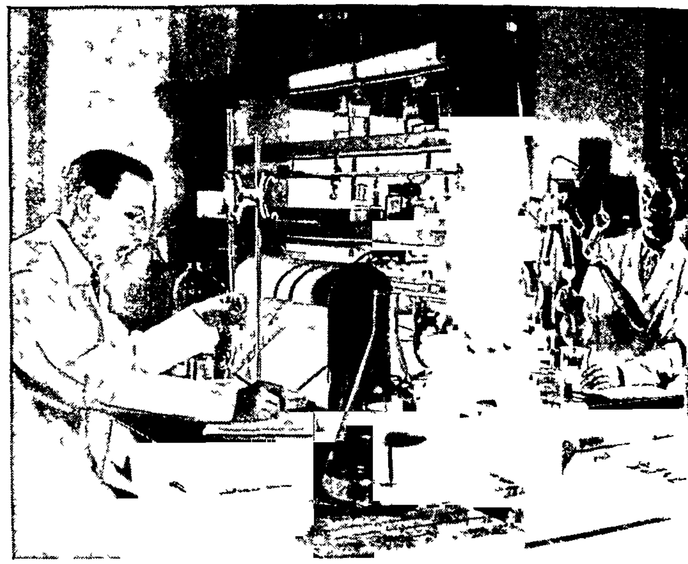
Training for a Medical Career

Because of the vast range and complexity of modern medicine, many years of training are needed before a student can become a doctor. The modern standard requires four years in a medical school after graduation from college. In college, the student takes

courses in biology, physics, chemistry, and zoölogy. In the first years of medical school he studies human and animal life, learning especially anatomy, physiology, and pathology. In the last two years, he spends a great deal of time in the hospitals that are affiliated with his medical school. Here he observes his teachers at work and gets first-hand acquaintance with diseases, injuries, and treatment. He also attends autopsies to watch the pathologist make detailed studies of bodies immediately after death. These examinations reveal the effects of disease on all the body's tissues and organs.

After graduation from medical school, the young doctor serves a year or more in a hospital as an intern. Here he carries his knowledge into active practise under the close supervision of hospital staff members. At the end of his internship, he is eligible to take the examination for licensure required by the medical licensing authority in his state.

TESTS IN MAKING A DIAGNOSIS



These highly trained specialists in a pathology laboratory are making chemical tests to help determine what is causing a patient's illness. Testing of this sort is available in all larger modern hospitals, and it helps greatly toward making modern medicine constantly more precise and effective.

If he wishes to become a specialist, the young doctor usually seeks a hospital appointment as a resident, or house, physician in the department of his choice. For one, two, or three years the young doctor works with patients in his special field, while assisting and learning from his superiors on the hospital staff. He may then spend two years more as an assistant to a practising specialist before he starts his own practise. If he wishes to be certified as a specialist he then presents himself for a detailed examination by the specialty board or organized group of specialists in his field of medicine.

The Long History of Medicine

Attempts to treat illness are almost as old as mankind itself. With primitive peoples, however, most illness was thought to be caused by evil spirits or angry gods. Treatment consisted of charms and ceremonies to remove this supernatural influence. Nevertheless, primitive medicine men had considerable knowledge, gained from practical experience, of herbs, diets, midwifery, bonesetting, and crude surgery.

The earliest civilizations also mixed magic and practical help in their medical practise. The ancient Egyptians used prayer to the gods and magic; but records show that as early as 2000 B.C. the Egyptians knew and used many helpful drugs. They splinted fractures in much the same way as is done today. To make a patient unconscious for surgery, they hit him on the head with a mallet. They also described many diseases well enough to be recognized today.

The Jews had sound concepts of hygiene and sanitation, even though their knowledge of infection was limited. The Hindus had many medicines, and their surgical practise included amputation, cauterization, splinting, removal of tumors, and operative childbirth.

The ancient Greeks brought medical treatment to the highest level attained in ancient times. Followers of Aesculapius, the Greek god of medicine, established temples of healing in all the Grecian states. The most famous was at Cos, an island in the Aegean Sea. Here Hippocrates, the Greek physician who is known as the "father of medicine," learned and practised his art 400 years before the birth of Christ.

Hippocrates is still remembered for his careful, detailed observations of various diseases, and the celebrated Hippocratic Oath. According to the oath, the physician places the interest of his patient above all other considerations in his practise. He keeps in strictest confidence all that he observes and learns during his visits to the homes of the sick. He confines his practise to the procedures for which he has been trained, and he pledges himself to teach as well as practise his art. These ethical rules still govern the practise of medicine.

In the 3d century B.C. a great medical center was developed in Alexandria. Here were the first dissections of the human body for teaching purposes. Herophilus recognized that the brain is the central organ of the nervous system, and Erasistratus contributed knowledge of the heart, lungs, and digestive system. Erasistratus also associated the complex workings of a human brain with intelligence. But the Greeks also invented theories which went beyond their proved knowledge. One example was the common belief that the body had four "humors"—blood, black bile, yellow bile, and phlegm. According to this theory disease occurred when the humors got out of balance. The physician's task was to restore the balance.

The early Romans relied for medical advice and care on *medici*, or medical slaves. Later they adopted Greek medicine and relied upon Greek-trained physicians. The best known of these was Galen of Pergamus, born in A.D. 131. Galen was a skillful healer and a persuasive teacher, but many of his theories

about physiology and disease were wrong. He recognized that the arteries contained blood instead of air, as the Greeks had taught; but he did not detect the circulation of blood between the arteries and the veins. He believed that life was supported by natural spirits formed in the liver, vital spirits formed in the heart, and animal spirits formed in the brain.

After Galen's time, the desire for progress seemed to die. During the Dark Ages in Europe, the Arabs cherished Greek knowledge and made some additions, but when interest in medical studies was rekindled in Europe Galen still was the great authority.

The first notable advances were contributions to the knowledge of anatomy, made by Leonardo da Vinci (1452–1519) and Andreas Vesalius (1514–64). The dissections and anatomical studies of Vesalius, in particular, corrected some of Galen's errors and inspired other anatomists to new studies.

Up to this time surgery was considered secondary to medicine and was left to barbers and their apprentices. The work consisted largely of bloodletting and in treating cuts and wounds. The "barber-surgeon" of the European town was a well-known figure but he did not have the culture or prestige of the physician.

A new impetus was given to surgery by the work of military surgeons in the constant wars of the 16th century. Foremost among them was the Frenchman Ambroise Paré (1517–90). Paré developed skillful, speedy techniques for amputating injured limbs. He also proved that tying severed arteries to stop hemorrhage was better than cauterizing with boiling oil (or, as was sometimes done, with a hot iron). He devised trusses and artificial limbs. Later, as court physician to several French kings, he found time to write books and spread knowledge of his work.

An Englishman, William Harvey (1578–1657), gave modern physiology its real start in 1628 with proof that the blood circulates continuously through the arteries and veins. Harvey's work was important not only for its revelation of truth but because he employed the scientific method of observation and deduction. He measured the quantity and velocity of the blood's flow and reasoned from these measurements that it was physically impossible for the blood to do anything else than return to the heart through the veins. This mathematical demonstration of biological fact was the foundation of modern scientific medicine.

The Dutch microscopist Anthony van Leeuwenhoek (1632–1723) studied healthy and diseased body tissues under the microscope and first identified disease-bearing parasites, although he did not recognize their function in disease. His contemporary, Thomas Sydenham (1624–89) of England, founded modern epidemiology. He observed the recurrent characteristics of infectious diseases; but he, like Leeuwenhoek, did not identify germs as the cause. John Hunter (1728–93), a Scot who practiced in London in the latter part of the 18th century and became the leading surgeon of his day, also made important discoveries. He described many different diseases but was especially shrewd in his diagnosis and treatment of diseases of the blood vessels. Edward Jenner contributed the first effective means of controlling infectious disease by developing vaccination for smallpox (*see* Jenner).

The 19th-Century Flowering of Knowledge

In the 19th century, medicine was practiced on a solid foundation of scientific knowledge. Improved, high-powered microscopes opened new possibilities for the study of tissue, and workers such as Matthias Schleiden (1804–81), Theodor Schwann (1810–82), and Rudolf Virchow (1821–1902) established the fact that all tissues are cellular in structure. The science of chemistry provided a new means for studying structures and processes, and knowledge of anatomy and physiology advanced accordingly.

The understanding and treatment of disease were advanced by Louis Pasteur, Robert Koch, and others in the 1870's and 1880's. They proved that infections and infectious diseases were caused by microorganisms, commonly called germs or microbes (*see* Koch; Pasteur). This discovery gave scientists the clue they needed for developing remedies for such diseases and for controlling diseases which previously had ravaged entire populations.

By preventing infection following operations, surgery also benefited from these discoveries. The pioneer in this development was the English surgeon Joseph Lister (1827–1912). During the 1880's he developed crude but effective methods which led to the aseptic methods used today (*see* Antiseptics).

This development cleared away the last obstacle to the rapid advance of surgery. Earlier, in the 1840's, anesthesia with ether (and later with chloroform) had ended the agony of operations for patients. Surgeons then had time for protracted operations; but they still dreaded entering the abdominal cavity and other bold procedures, through fear of infection. Lister's work overcame this obstacle and surgery then entered upon its modern phase.

Another milestone of 19th-century progress was the discovery of X-ray by Wilhelm Roentgen of Germany in 1895. This discovery was a powerful aid in diagnosis and also provided a means of treatment for many diseases. (*See also* X-rays.)

During the 20th century, new physical, chemical, and biological techniques brought tremendous progress in the development of helpful procedures. Especially important were the discovery of the part played by vitamins and glandular secretions and the discovery of powerful germ fighters such as the sulfa drugs, penicillin, and other antibiotics.

These new developments by no means conquered all diseases. Many still remain baffling or incurable. In view of the strides made in scarcely more than a century of sound scientific studies, there is every hope that progress will be made with these problems.

MEDITERRANEAN SEA. Thousands of years ago the Mediterranean was the center of the world and its first school of navigation. Today, with Asia and Africa assuming new importance along its shores and Europe in new rivalries, the Mediterranean becomes again a center of the world's interest. In other articles

is told the story of the empires and peoples that have lived and still live on its borders. Here we can give only the chief physical facts of this largest inland sea in the world.

The Mediterranean is about 2,100 miles long, and about 1,000 miles at its widest, from the head of the Adriatic to the Gulf of Sidra. Its area is 843,000 square miles, excluding the Adriatic and Aegean seas, and 963,100 square miles with these bodies of water. It is almost entirely inclosed by Europe on the north and northwest, Africa on the south and Asia on the east, with a narrow opening into the Atlantic at the Strait of Gibraltar and another narrow opening into the Black Sea at the Dardanelles. In summer the northeast trade-winds blow over it and in the winter the prevailing winds are westerly. Under bright blue skies, and over a dark blue sea, with fragrant land winds blowing far out over the waters from fertile *shores, and with island after island almost in sight of* one another to lure him on, primitive man ventured from end to end of it in boats which were probably just a hollowed log propelled by paddles.

Early History of the Mediterranean

Remains of the times before recorded history are found in a hundred places on its coasts and islands, and even past the Strait of Gibraltar. The first venturers known to history, however, were the Phoenician traders who established commercial colonies here and there along the shores and islands as far west as Cadiz in Spain. The Phoenicians were followed by their daughter colony Carthage. The Greeks colonized too, and the Sicilian tyrants sailed the Mediterranean in barges luxurious with statues and fountains. Later the sea became simply a Roman lake, and everywhere about its shores, whether in Europe, Asia, Africa or the islands, you will still find ruined temples, baths, and aqueducts, to remind you of the empire. In all times the Mediterranean has been infested by pirates as well as by peaceful traders and colonists. In our own day the submarine warfare gave Mediterranean navigators a taste of what their ancestors experienced in the Middle Ages when Christian and Saracen, Berber pirates, Genoese sailors, Spaniards, and Knights of Malta boarded one another's ships, and fought for control of the waters which in those days carried most of the world's commerce.

Various parts of the Mediterranean are known by various names, the part east of Crete as the Levantine Sea, that which separated Turkey in Europe and Greece from Turkey in Asia as the Aegean, that between the west coast of the Balkan Peninsula and Italy and Sicily as the Ionian, that between the east coast of Italy and the west coast of Turkey and Dalmatia as the Adriatic, and that between the west coast of Italy and the islands of Sardinia and Corsica as the Tyrrhenian or the Tuscan Sea. There are really only two great basins, the eastern and the western; of these, the eastern is the larger. They are divided by a submarine ridge which connects Italy to Sicily, Malta, and the African coast. This barrier is a center of volcanic activity, marked by Vesuvius in Italy, Etna in Sicily, and Stromboli thundering down great balls of lava on the Lipari Islands. This subterrranean seething has sometimes cast up islands almost overnight. The greatest depth in the eastern basin is 15,240 feet, south of the Morea; and in the western basin, 12,173 feet, east of Sardinia. At Gibraltar the depth is 1,800 feet and 50 miles to the west only 1,200. The chief islands of the western basin are Sicily, Sardinia, Corsica, and the Balearic group. In the eastern basin, the main islands are Cyprus, the Dodecanese, including Rhodes, the Cyclades, the Sporades, Crete, the Ionians, and Malta.

Were it not for the stream flowing in from the Atlantic, the Mediterranean would no doubt dry up in a short time to a salt desert like the former seas of Asia, for the sea loses three times as much by evaporation as it gains from the few great rivers that flow into it, the Ebro, Rhone, and Po from Europe, and *the Nile from Africa. From the Black Sea—replen*ished by several great rivers—there is also a strong current. The Suez Canal opened in 1869 connects it through the Red Sea with the Indian Ocean and restores the Mediterranean to the old place as a link in the route to India and the Far East. The Mediterranean contains 400 species of fish, about twice as many as any other sea. Sponge, tunny, and sardine fisheries are important, and divers bring up a wealth of red coral on the coasts of Provence, the Balearic Islands, Sicily, Tunis, and Tripoli.

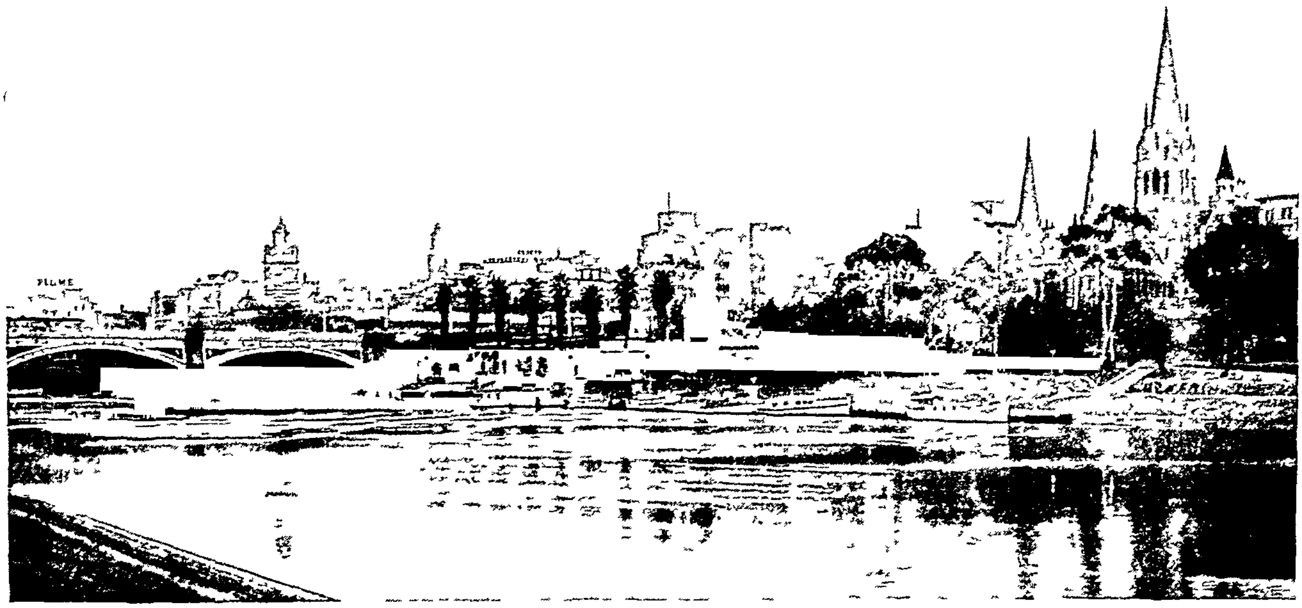
MEERSCHAUM (*mēr'shạm*). The name of this mineral is borrowed from the German and means "sea-foam." It is a white or cream-colored claylike substance, which when dry will float on water. When first dug from the earth it is soft, like soap, and it makes a lather in water, and takes out grease; chemically it consists of hydrated magnesium silicate. In Europe it is found in Moravia, Spain, and the Crimea, and in Asia Minor there are large beds of it just below the soil. It is also found in South Carolina.

The best quality comes from Asia Minor. It is mined in blocks about a foot each way, and is carefully packed in cotton to avoid damage in shipment. Meerschaum pipes being porous absorb color from the burning tobacco and take a high polish. Vienna and Paris are the manufacturing centers.

MELBOURNE (*mĕl'bûrn*), **AUSTRALIA**. The young city of Melbourne was growing at a steady but not remarkable rate along in the 1840's. In 1851 enormous gold fields were discovered near by, and Melbourne's story became the dazzling one of a great gold-mining center. Today the beautiful city, in the center of a highly productive agricultural region, is notable for its manufactures and is a shipping point for wool, wheat, wine, fruit, and other products. The second largest city in Australia, Melbourne is the capital of the state of Victoria, which is in the extreme southeastern corner of the continent.

The site of Melbourne was first settled in 1835 by pioneers from Tasmania who were seeking more extensive pasture lands for their flocks and herds. They "bought" the land from the natives in exchange for

AUSTRALIA'S SECOND CITY AND ITS QUIET RIVER



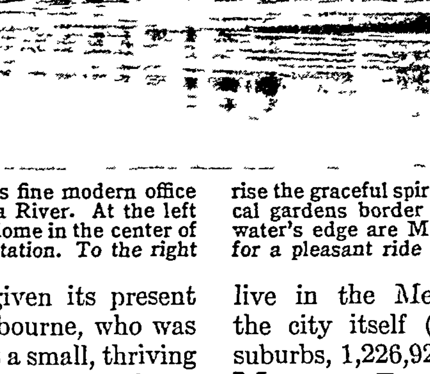
Melbourne's main business district, with its fine modern office buildings, overlooks the banks of the Yarra River. At the left is Princess Bridge. The building with the dome in the center of the picture is the Flinders Street railway station. To the right rise the graceful spires of St. Paul's Cathedral. Beautiful botanical gardens border the river. The little white launches at the water's edge are Melbourne ferries waiting to take passengers for a pleasant ride upon the tranquil stream.

some trifling gifts. The city was given its present name in 1837 in honor of Lord Melbourne, who was then Britain's prime minister. It was a small, thriving settlement by 1841, was incorporated a year later, and became a city in 1848. In 1851, when the great gold deposits were discovered not many miles away, the city became the center of a great boom. Within ten years its name was known around the globe, and for more than 40 years it was the largest city in all Australia. Then it was overtaken by Sydney.

People from all walks of life hurried to join the gold rush. Even government officers and policemen deserted their work to seek a quick fortune, and public officials had to offer increases in salary to maintain their forces. Within the first ten years of their development the mines near Melbourne produced an average of more than $50,000,000 worth of gold a year.

Far-sighted planning and the work of expert surveyors assured Melbourne ideal conditions for growing into a great city. Some of its streets are almost a hundred feet wide and are lined with palm trees. Melbourne is justly proud of its beautiful Botanical Gardens and other parks, its university, churches, library, national museum, and art gallery. There are miles of beaches and choice picnic spots for leisure hours. The Yarra River is the scene of the celebrated annual regatta and water carnival. The Melbourne Cup race rivals that of Epsom Downs in England. More than half the people of the state of Victoria live in the Melbourne area. The population of the city itself (1947 census), is 99,868; including suburbs, 1,226,923.

ROCKY FORD TWINS



Here are two excellent reasons for the fame of the Rocky Ford district in southeastern Colorado. These are fine examples of the netted muskmelons grown there.

MELONS. Every autumn the little town of Rocky Ford, Colo., in the center of a famous district which helps to make the United States the largest melon-growing country in the world, holds a gala "melon day." Championship contests are held to determine who can eat a melon the fastest and who can eat the greatest number. Rocky Ford has been noted for its melons since about 1900, when it started shipping carload lots to distant markets.

Melons are generally oval-shaped fruits, growing on vinelike plants. A protective outer skin covers their thick fleshy pulp, which in turn encloses the many seeds. The surface may be smooth or grooved. Since ancient times melons have been grown in the warm regions of Europe, Asia, and Africa. Many varieties are cultivated today in the temperate and warm regions throughout the world. In addition to their use as fresh fruits, melons are also used as pickles and preserves. The two types of melons which are the most popular are the muskmelons and the watermelons.

The Fragrant Muskmelon

Muskmelons are so called because they have an aroma suggestive of musk. The chief producing areas in the United States are in California, especially in the Imperial Valley; in Colorado, the home of the famous Rocky Ford varieties; and in Arizona, Georgia, North

THE UNITED STATES HAS MORE THAN 250,000 ACRES OF THESE

Watermelon fields such as this dot the warmer sections of the United States. Watchful care has prevented these fine specimens from falling prey to the harmful insects or destructive diseases that often attack the fruit. Watermelons are shipped as early as April from the South; the winter varieties are sent out from California and Colorado as late as December.

Carolina, Maryland, New Jersey, and Arkansas. California provides about half the total shipments. Muskmelons are customarily divided into two groups. the netted or nutmeg melon and the winter or Casaba melon. People in the muskmelon trade usually apply the word "cantaloupe" (also spelled "cantaloup" or "cantelope") to the netted melon, or even to any muskmelon. The true cantaloupe, or rock melon, is almost unknown outside of Europe. It is named for Cantalupo, Italy, where it was first grown.

The netted melons fall into two groups: the Defender group and the Netted Gem group. The former have green rind, deep salmon flesh, and are sweet flavored. Some of the varieties are Paul Rose, Admiral Togo, Hale Best, and Hearts of Gold. Outstanding in the Netted Gem group are the melons developed at Rocky Ford. Netted Gem melons are solidly netted, and have salmon, golden, or (as in the case of the Honey Ball) green flesh. Varieties are Pollock, Edwards Perfecto, Abbott Pearl, and Honey Ball. In home and market gardens other varieties are grown.

Of the winter melons, the Casaba is among the best known. It was first grown at Kasaba, near Smyrna, in Asia Minor. The name is now often applied to the whole group of similar melons. It is very sweet, relatively smooth and thin-skinned, greenish yellow outside and white or green within. It ripens late and keeps well in cold storage. It grows best in hot, dry sections. Varieties are Golden Beauty, Santa Claus, and the well-known Honey Dew. The Honey Dew is a large smooth melon of a delicately delicious flavor, greenish white outside and deep green within. It stands shipment and storage well.

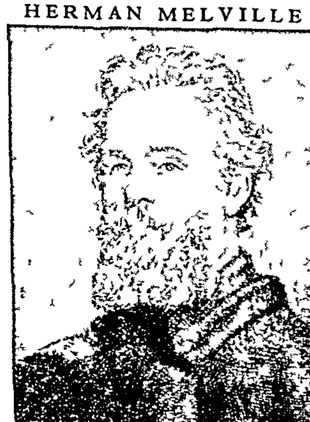
Muskmelons grow best in well-watered sandy or clayey loam soils. Warm, sunny locations and a dry atmosphere produce the finest fruit.

The watermelon is a much larger fruit with smooth, dark-green spotted or striped rind. It probably gets its name from the fact that it has an abundance of watery juice. In the United States the chief producing areas are in Georgia, Florida, California, Texas, South Carolina, and Missouri. Watermelons weigh from about 18 to 50 pounds, or even more—the record weight being about 200 pounds. A standard watermelon for shipping weighs about 33 pounds, though smaller or larger ones are also shipped.

The pulp of the watermelon usually ranges from pink to a rich scarlet, though it may be yellow or white. The varieties having red flesh that is firm, crisp, and sweet, with as few seeds as possible, are the ones usually cultivated for shipment. Among the best standard varieties are Tom Watson, Thurmond Grey, Irish Grey, Excel, Florida Favorite, Klondike, and Dixie Queen.

The melon belongs to the gourd family *Cucurbitaceae*, which also includes cucumbers, squashes, and pumpkins. Scientific name of muskmelon, *Cucumis melo;* of watermelon, *Citrullus vulgaris*.

HERMAN MELVILLE



Melville wrote the American classic novel 'Moby-Dick'.

MELVILLE, HERMAN (1819-1891) During his four years as a sailor and beachcomber in the South Pacific, Herman Melville gathered rich material for several novels. One of them was 'Moby-Dick', a story of Captain Ahab's vengeful search for the white whale which had maimed him On the surface 'Moby-Dick' can be read as an exciting adventure story. At a deeper level it is a profound study of man's struggle against the forces of evil. 'Moby-Dick' ranks as one of the greatest American novels.

Melville was born in New York City on Aug. 1, 1819. His father was of Scottish descent and his mother came from an old Dutch colonial family. Herman was the third of eight children. His father died when the boy was 12. Herman was silent and slow; his mother considered him a dull child. He finished school when he was 15 and for two years worked at a series of jobs. Then he signed on as cabin boy aboard the *Highlander* bound for

Liverpool, England. He left the ship when it returned to New York, but he could not forget the sea.

In 1841 Melville took a berth as ordinary seaman aboard the whaler *Acushnet*. The ship left Fairhaven, near New Bedford, Mass., for an extended voyage around Cape Horn and into the South Pacific. The life was harsh and oppressive, and after 18 months Melville and a companion "jumped ship" at the Marquesas Islands. For several weeks they lived with the natives, then went aboard an Australian whaler. At Tahiti Melville went ashore and for about a year he worked as a laborer. Finally he signed on the frigate *United States* and was discharged 14 months later when the ship docked at Boston.

Almost at once Melville began to set down his experiences. Within six years he published 'Typee', 'Omoo', 'Mardi', 'Redburn', and 'White-Jacket'. He married and later moved his family from New York to a farm near Pittsfield, Mass. Nathaniel Hawthorne lived near by, and the two authors became friends. Here Melville wrote 'Moby-Dick'. He threw himself into the work and at the end was near collapse from overwork. It was published in 1851; and Melville at once began 'Pierre', published in 1852. His first books were popular, but these last two were attacked by the critics and virtually ignored by the public. Melville continued writing, but he never again approached the power and sweep of 'Moby-Dick'.

Melville's income from writing and farming was not enough to support his family, so he tried lecturing. His failure made him draw even closer into himself. Finally he became a customs inspector in New York City. He held the post for 19 years and was almost completely forgotten as a writer. He wrote some poetry and a story, 'Billy Budd', completed three months before his death on Sept. 28, 1891.

For decades Melville's books lay in obscurity. But after the first World War, students of American literature rediscovered Melville. Today his works enjoy a wide critical and popular audience.

MEMNON. In Greek mythology, Memnon was the son of Eos (Aurora), goddess of the dawn. As king of the Ethiopians, he came to the aid of Troy toward the end of the Trojan War. He slew Antilochus, the son of Nestor, in single combat and was himself slain by Achilles. The colossal statues of King Amenhotep III of Egypt found near Thebes were supposed by the Greeks to be sacred to Memnon. Two of these still stand. One of them, after its partial destruction by an earthquake in 27 B.C., was said to give out musical notes at sunrise. Modern travelers who have heard the sound ascribe it to the rapid passage of the air through the pores of the stone when heated by the rays of the sun. The Greeks called it the voice of Memnon hailing his mother.

MEMORIAL DAY. Each year every state in the Union sets aside a day to commemorate the services of the soldiers and sailors in the Civil War and, since 1898, of those in the Spanish American and other wars. The custom arose from the practise in the South of decorating the graves of the Confederate dead. From this came the name "Decoration Day." Today it is observed in all states, North and South alike; and in most of the states on the same day—May 30. In many localities the day has come to be a commemoration for all dead, and graves even of those who were not soldiers are decorated with flowers and wreaths. (*See also* Festivals and Holidays.)

WHERE MEMORIAL DAY MAY HAVE STARTED

Clad in the costumes of the 1860's, these girls decorate the graves of Confederate and Union soldiers in Friendship Cemetery at Columbus, Miss. One tradition states that the first Memorial Day was held here on either April 25 or 26, 1866. But more definite evidence shows that the first observance of Memorial Day was held on April 26, 1866, at Linwood Cemetery at Columbus, Ga.

MEMORY. Remembering is one of the most important things you do. Yet ordinarily remembering is done with so little effort that you may not realize how complicated it actually is. Psychologists define memory as the knowledge of an event or fact coupled with the further knowledge that the particular event or fact has been experienced at some time in the past.

To understand memory, we must split up the process into its several phases or parts. Of these the first is called *association.* This means the coming together of the two experiences so that the thought of one brings up the thought of the other. As I was walking down the street one day two automobiles collided at the corner of Main and First streets. Whenever I pass that corner I think of the collision. I do not think of it when I pass another corner, because no association was made between the other corner and the collision.

The second phase of memory is known as *retention,* and refers to your power to retain associations in your mind. It varies from individual to individual, and seems to be based upon a native quality of the nervous system. The opposite of retention is forgetting. We forget most in the first hour, less in the next, less in the next, and so on. After the first 24 hours, the rate of forgetting is relatively slow.

A student studying French, for instance, finds that he learns the meaning of 50 French words one day; the next day most of the words will be forgotten. If, however, he practises the forgotten words the next day, and on succeeding days, in the course of time he will master the list completely. In school we do not study arithmetic for one whole day, grammar the next day, and geography the next day, but we study arithmetic, grammar, and geography each day for short periods, in order that we may reinforce the memory bonds which have been weakened through the rapid forgetting that takes place during the first 24 hours.

The third phase of memory is usually spoken of as *recall,* and refers to the ability of the individual to bring up, under the appropriate circumstances, that which has been associated and retained. If I ask you a question such as "What is 9 times 6?" you may immediately say "fifty-four," thus recalling what you have previously learned and have retained. On the other hand, you may be unable to give an answer at the immediate moment, yet a few minutes later recall perfectly, thus indicating that the material has been retained.

The ability to recall under appropriate circumstances is obviously the test of memory. Thinking of the answer to a question in your examination paper after you have left the room is of little value in comparison with thinking of the answer when the question is asked. The ability to recall depends in large part upon the number of associations which have been formed with the particular fact to be recalled. The great opportunity for improving memory lies here. Each association forms a "handle" by which to pick out of the storehouse of your brain the fact you need.

The fourth phase of memory is called *recognition,* and refers to the "tagging" by which we assign the experience a place in our earlier life. It is the feeling of "pastness" or familiarity. Ordinarily, recall and recognition go hand in hand; occasionally, however, recognition occurs without recall. A face may be familiar, yet call no name to mind.

In the experimental work upon memory, two types of material are used: first, nonsense syllables composed of two consonants with a vowel between, such as *ken, tih,* and *yan;* second, meaningful material such as prose and poetry. It is found that a much greater proportion of the meaningful material than of the nonsense material is retained. In other words, learning by rote is much less effective than learning by means of logical connections. The better you understand a thing, the better you will retain it.

Persons differ in the kinds of things they remember easily. Some remember things they have seen better than things they have heard, while others may do the reverse. In good teaching, an attempt is made to present the material to the student in various ways: he reads about it in a book, he discusses it in classes, he looks at diagrams, illustrations, and motion pictures. In some courses he works with the material in field, laboratory, or shop. All these methods multiply the handles of association with which a person can grasp the required fact when need arises.

Simple Ways to Improve Memory

Instead of the complicated systems for improving the memory which have been exploited for commercial purposes, modern psychologists rely on a few simple principles. Of these the first is that repetition tends to fix associations. "Over and over again" is the best rule. But repetition is not sufficient. It is necessary to concentrate your attention upon what you are trying to learn. You cannot learn a poem if you are thinking of a baseball game. Interest in what you are learning is essential.

The difference between rote memory and logical memory brings forth several additional principles. Of these the first is that a good memory depends upon a wise selection of what is worth memorizing. Many people learn too many insignificant details. Selection, thinking, and perspective are as important in memory as in other phases of life. Of two men with an equal array of facts at their command, one may be much more efficient than the other, because he remembers the important and essential, while the other remembers the trivial and insignificant.

Perhaps the foremost principle of efficient memorizing is the principle of recall during memorizing. If immediately after reading, the student closes the book and tries to recall what he has read he will find his ability to retain much increased.

If you outline what you are learning, run it over in your mind, discuss it with a friend—in other words, *do* rather than merely *receive*—you will find your memory greatly improved, particularly if the practise is kept up. (*See also* Learning; Study.)

MEMPHIS, TENN. The largest city of Tennessee is in the southwestern corner of the state, on the Fourth, or Lower Chickasaw, Bluff overlooking the Mississippi River. This is the southernmost of the series of bluffs on which the Chickasaw Indians built their villages before they sold their lands to the white man. Here De Soto is believed to have first seen the great river, in 1541, and here he built the boats in which he crossed it.

The position of Memphis midway on the Mississippi and its superior transportation facilities by rail and barge line have made it one of the South's great commercial and industrial cities and one of the busiest river ports in the country. Three bridges carry heavy railroad and highway traffic across the river. The rich alluvial farms and forests of western Tennessee, eastern Arkansas, and northern Mississippi send their cotton and lumber here. The city is one of the world's greatest inland cotton markets and one of the greatest hardwood lumber markets. In the manufacture of cottonseed products it leads the country. Furniture and other wood manufactures, and stock and poultry feeds are other important products.

The principal avenues radiate from the river past Crosstown, the business area, to join the Parkway, which makes a half circle around the city. At the river front it meets Riverside Drive. The largest of the many wooded parks lie along these drives. In Overton Park are the Brooks Memorial Art Gallery and a zoological garden with a free circus for children.

The University of Tennessee maintains its colleges of medicine and dentistry and its schools of pharmacy and nursing in Memphis. Here too are Southwestern, and the Memphis State College. The Cotton Carnival, begun in 1931, attracts thousands of visitors every May. Beale Street, center of the Negro district made famous by W. C. Handy, Negro composer of "blues" songs, has its own Cotton Pickers' Jubilee.

During the 17th and 18th centuries French, English, and Spaniards contested for this commanding site. In 1818 the Indians ceded their lands to the United States. The next year a settlement was laid out, which was incorporated as a town in 1826, and granted a city charter in 1849. It was named Memphis after the famous ancient Egyptian city, because of its situation, like the city of the Nile, on a great river. During the Civil War Memphis was the scene of an important naval battle, which resulted in its capture by Union forces. The city's progress was impeded by terrible epidemics of yellow fever that ravaged it in 1855, 1867, 1873, 1878, and 1879. During the epidemics of 1878 and 1879 fully two-thirds of the population fled, business was almost paralyzed, and the city was on the verge of bankruptcy. Memphis has now established a reputation as a healthful, progressive city. The government has been by commission since 1909. Population (1950 census), 396,000.

MEN'DELSSOHN, FELIX (1809–1847). Most great musicians have become famous in the face of handicaps, but in the case of Mendelssohn-Bartholdy (to give him his full name) there was never a day when he lacked anything that money or friends or education could supply. His parents were wealthy and cultured Jews whose home in Berlin was a meeting place for artists and scholars. At the age of four his lessons in music began, and at the age of nine he composed pieces for the family orchestra. At 15 he composed and directed a three-act opera that took his audience by storm. When soon after in London he played his 'Symphony in C' in concert, people from the audience leaped upon the stage to congratulate him.


MENDELSSOHN

The account of Mendelssohn's life is a story of pleasant and profitable work. His wonderful ability to extemporize and his willingness to play the compositions of other musicians made him a popular concert performer. His compositions were always in demand. In Germany he was idolized by all music lovers, and in other countries he was always received with acclaim.

His happy marriage duplicated the home experiences of his youth. Among the friends of his manhood were such as Jenny Lind, Robert Schumann, Hiller, Moscheles, and his own favorite sister Fanny, a musician of great merit. The University of Leipzig, to which city he had removed to direct the public concerts, conferred on him the degree of doctor of philosophy, and there he organized the famous musical conservatory of Leipzig.

No composer has enjoyed more general popularity in Germany, America, and England. The list of his compositions is long. His oratorios 'Saint Paul' and 'Elijah' are sung everywhere. His 'Hymn of Praise', written in celebration of the invention of printing by Gutenberg, is known to all, as is his music to 'Midsummer Night's Dream', with its much-used 'Wedding March' and nocturne. His 'Songs Without Words' are on almost every piano. As a composer he enriched musical literature with his graceful, polished compositions, with joyous melodies, and simple rhythms and harmonies. But it was as a concert pianist and conductor that he performed what was perhaps an even greater service, for he persistently played the music of Bach, and his devotion brought the work of that neglected genius to universal attention.

At the time of Mendelssohn's death, the city of Leipzig mourned as though a king had died.

MENTAL DEFICIENCY. The study of mental deficiency, or feeble-mindedness, began about 1800 when a "wild boy" was discovered in France roaming in the woods. A Paris physician, J. G. M. Itard, undertook to educate him. Itard found that the boy was an idiot; but the doctor continued with ingenious exercises. A pupil, Edouard Seguin, developed Itard's methods. Soon a world-wide movement started to provide better care of the mentally defective.

All children who fail to develop normally are not mentally defective. Some are emotionally unstable. Others are held back in school because of poor eyesight, deafness, bad health, or unfortunate home conditions. Until the development of intelligence testing in the present century, there was no way to distinguish such children from the feeble-minded. Now psychologists can not only distinguish the feeble-minded from the normal, but they can measure various degrees of feeble-mindedness. On the basis of tests given in schools and in the army, it seems that about 3 per cent of the people in the United States are mentally retarded. Of these only a very small proportion need to be kept in institutions.

Psychologists class as definitely feeble-minded those persons who have an I.Q. (intelligence quotient) of 65 or below. An I.Q. of 65 to 70 is "borderline." (For an explanation of the term I. Q. *see* Intelligence Tests.) In the group of feeble-minded are three classes: *idiots* (I. Q. below 25), *imbeciles* (from 25 to 50), and *morons* (from 50 to 70). The *idiot* group includes those whose general intelligence is below the normal for three years of age. They are usually unable to feed or dress themselves or to avoid ordinary dangers, and they develop almost no command of speech. *Imbeciles* are those whose intelligence corresponds to that of normal children between three and seven years of age. They cannot progress beyond the first or second grade of school work, though they can perform simple industrial tasks under supervision. They gain some command of language but their ideas are very limited. Imbeciles, like idiots, must usually be placed in an institution or must receive constant care at home. *Morons* have mental capacities like those of normal children between eight and twelve years of age (*see* Intelligence Tests). They may succeed in school work up to the fourth or fifth grade, but they do not show good judgment in managing their own affairs. Under unfavorable circumstances they may become wayward or delinquent.

Unfavorable heredity is the principal cause of feeble-mindedness, and is said to account for about two-thirds of all cases. The remaining one-third are victims of accidents or pathological conditions such as abnormal glandular function, birth injuries, or the after effects of serious diseases.

No measures have been found to convert the feeble-minded into normal persons except in the case of *cretins*, who are mentally and physically retarded because their thyroid glands are not doing their proper work. But much is being done to improve the lot of the feeble-minded. Beginning about 1850, nearly every state in the Union has established institutions for them, and many private institutions have been founded. All together, they care for about one-twentieth of the estimated total number of feeble-minded in the country. Under the most successful methods of training, high-grade imbeciles and morons who are of stable disposition and reasonably industrious may ultimately become adjusted to life outside the institution.

Special classes have been established for mentally deficient children in progressive school systems, though most such children are still being taught unsuccessfully in the regular grades. Research laboratories have been established for the study of feeble-mindedness and many university psychology laboratories are paying particular attention to the subject. These scientific studies have shed a great deal of light on the understanding and training of the feeble-minded. They have also contributed to our knowledge of the mental development of normal children and have had a marked influence in modifying methods of education.

MENTAL HYGIENE. We have long known that the laws of physical hygiene must be observed if the human body is to play its part well. Only recently, however, have we learned that there is a hygiene of the mind as well as of the body; that we can so direct our emotions and so adjust ourselves to our ever-changing environments as to make our lives happier and more useful.

The chief aim of mental hygiene is to preserve and develop mental health. It deals with such aspects of life as envy and worry and anger and discouragement, and teaches how to replace them with poise, courage, and contentment. It uses facts from any helpful source, especially those from philosophy, religion, psychology, physiology, anthropology, sociology, economics, and medicine. It organizes these facts and approaches results in an effort not only to solve problems of the individual but also to increase our knowledge and arrive at a broader understanding. Mental hygiene, then, is a science in the making; an art comparable to medicine; and a movement to stimulate interest in both the science and the art.

The practise of mental hygiene may be defined as a scientific effort to develop and preserve the state of mind in which a person does the best work of which he is capable, lives with the least possible friction with his environment, and attains the greatest happiness in all phases of his life. Every human being, old or young, constantly faces the problems of *making the most of himself* and "getting along" with teachers, playmates, parents, and other people.

Since the principles of mental hygiene are most helpful when they are applied early in life, they are being used by parents, teachers, recreation supervisors, nurses, and physicians. Only a few specialists devote all their time to the practise of mental hygiene. With the exception of the home, the school is the best place for training persons to meet life properly. It teaches adjustment to their environment.

A person who is poorly adjusted to life becomes mentally, and sometimes physically, ill. Such cases should then be placed in the hands of a physician who is specially trained in that branch of medical science known as *psychiatry*. The name comes from the Greek word *psyche*, meaning mind. The psychiatrist seeks to discover the cause of the mental disorder. He may find it in some physical condition which can be treated with medicine or by surgery. Some conditions which have no discernible physical basis can be helped nevertheless by physical treatment. Shock therapy such as that produced by electricity or drugs has proved helpful in many disorders.

A companion field in the treatment of the mind is psychology (*see* Psychology). Psychologists need not be graduate medical doctors nor licensed to practise their therapy. But all properly qualified psychologists are recognized by the American Psychological Association in Washington, D. C.

The term "mental hygiene" belongs principally to the 20th century, although it was used in medical literature before 1900, and was the title of a book published by Isaac Ray in 1863. It came into general use in 1907, when it was applied to a movement to improve conditions in hospitals for patients suffering from mental disorders. This movement was started largely through the efforts of Clifford Beers, who set forth his personal experiences as a patient at such hospitals in his book 'A Mind that Found Itself'.

The Connecticut State Society for Mental Hygiene was established in 1908. Out of it grew a national organization the following year. It was named the National Committee for Mental Hygiene, at the suggestion of Dr. Adolph Meyer, who was one of the pioneers of the movement. Since then the term mental hygiene has been loosely used in medicine, psychology, education, social service, industry, and other fields for all efforts to promote mental health. This too-inclusive use of the term has led to much misunderstanding of mental hygiene and its contribution to the happiness and efficiency of mankind.

MERCERIZING. John Mercer, an English dealer in cloth, announced in 1844 a chemical process for giving a high luster to cotton cloth. The process today perpetuates his name. It consists of steeping the fabric, yarn, or thread in a solution of alkali (caustic soda or caustic potash) in a cool temperature, then putting it under tension, and finally rinsing it.

As a result of chemical action, the cotton fibers, which were originally flattened spiral tubes, are drawn closer and made straight and translucent, so that they present a smooth surface that reflects light and gives luster. When cotton is properly mercerized the luster is permanent. Cotton cloth or yarn thus treated is softer and stronger, and takes more brilliant colors in dyeing. Sometimes a variation in the caustic soda process is employed to give the modern crimped or crêpe effects.

'MERCHANT OF VENICE'. In this comedy Shakespeare portrays the magnificent womanhood of Portia against the dark, malignant power of Shylock, the Jew. Bassanio, soldier and scholar, and the "best deserving of a fair lady"; Gratiano, the madcap wit in his following; Jessica, that "most beautiful pagan, most sweet Jew," daughter of Shylock; and the "merchant of Venice" himself—Antonio "the kindest man"—form a galaxy of stars in this enthralling play. It contains, also, some of the greatest passages of Shakespeare's dramatic writing. One of these is Shylock's savage arraignment of his persecutors:

> Hath not a Jew eyes? Hath not a Jew hands, organs, dimensions, senses, affections, passions? Fed with the same food, hurt with the same weapons, subject to the same diseases, healed by the same means, warmed and cooled by the same winter and summer, as a Christian is? If you prick us, do we not bleed? If you tickle us, do we not laugh? If you poison us, do we not die? And if you wrong us, shall we not revenge?

Another much-quoted passage is Portia's matchless speech in reply to Shylock:

> The quality of mercy is not strained,
> It droppeth as the gentle rain from heaven
> Upon the place beneath: it is twice blest;
> It blesseth him that gives and him that takes:
> 'Tis mightiest in the mightiest: it becomes
> The throned monarch better than his crown;
> His sceptre shows the force of temporal power,
> The attribute to awe and majesty,
> Wherein doth sit the fear and dread of kings;
> But mercy is above this sceptred sway;
> It is enthroned in the hearts of kings,
> It is an attribute of God himself;
> And earthly power doth then show likest God's
> When mercy seasons justice. Therefore, Jew,
> Though justice be thy plea, consider this,
> That, in the course of justice, none of us
> Should see salvation: we do pray for mercy;
> And that same prayer doth teach us all to render
> The deeds of mercy.

MERCURY. This is the only metallic element that is fluid at common temperatures. It is from this fact that it receives its common name "quicksilver," meaning "live" or fluid silver. The name "mercury" is given it from the fleet-footed Roman god Mercury.

Pour a little of this silvery metal on a piece of paper and notice that it does not spread like water, but forms a flattened ball, which will form still smaller balls if broken up. It is very cohesive and dense, being about 13½ times as heavy as water. Mercury's chemical symbol is Hg, for hydrargyrum (an ancient word coined from the Greek words *hydor*, meaning "water" and *argyros*, meaning "silver").

Mercury has been known since early times. Its brilliance, great weight, and unusual quality of being a liquid metal attracted medieval alchemists, who used it in their attempts to transmute base metals into gold. Physicians used it as a medicine and as a powerful antiseptic.

Some free mercury is found, but it occurs chiefly in the ore called cinnabar, a bright red mercuric sulphide. It is easily separated by heating the ores in retorts and condensing the vaporized mercury. The world's chief mine, the Almadén in Spain, dates from 800 B.C. Italy and Spain have produced in recent years about 65 per cent of the world's output. Next in production is the United States, followed by Russia, Mexico, China, Japan, and Germany. The United

States in some years imports more than half of the mercury that it uses. California, Nevada, and Oregon produce most of the output in the United States. The remainder comes mostly from Texas, Arkansas, Arizona, Utah, Washington, and Alaska.

Mercury freezes at 38 degrees below zero (Fahrenheit) and boils at 675°. The great range between these two points and its uniform expansion under heat make it useful in thermometers and barometers and in many scientific instruments. Its high boiling point makes it of value in a new type of power plant. It is used in compensating clock pendulums, heat-control devices, gas-pressure and tank gauges, for flow meters, and many automatic control instruments. Because it expands under heat, mercury is used in thermostats and for electric power control switches. Midget batteries containing mercury are widely used in hearing aids and in very small radios. Mercury vapor is used in ultraviolet lamps and in rectifiers and oscillators.

The metal is also used in the manufacture of disinfectants, turf fungicides, in making pigments such as vermilion red (called "English mercury"), in fireworks, for wood preservatives, boiler compounds, and antifouling marine paints, and in some of the processes of manufacturing felt, glacial acetic acid, chlorine, and caustic soda.

Mercury mixes readily with many powdered metals, forming soft alloys, or *amalgams*. Placer miners use mercury to extract gold dust from gravel (*see* Gold). An alloy of mercury and tin is used to silver mirrors. Dentists use a silver amalgam for fillings.

An explosive called fulminate of mercury is widely used to make percussion caps for cartridges and detonating caps used in blasting. Calomel (mercurous chloride, HgCl) is a familiar preparation which must not be confused with corrosive sublimate (mercuric chloride or bichloride of mercury, $HgCl_2$), a deadly poison used as an antiseptic. Mercurochrome, a complex dye containing mercury, is also an antiseptic. There are around 3,000 uses for mercury.

Mercury is shipped and sold in 76-pound flasks. The consumption in the United States in an average year amounts to more than 40,000 flasks.

MERMAIDS. In ancient and medieval legends the mermaid was represented as a woman with a human head and body ending in the scaly tail of a fish. Many stories were told of mermaids enticing human lovers to the depths of the sea. Mermen, the male counterparts of mermaids, played a less important part in legend. Mummified "mermaids" have long been a favorite hoax of showmen (*see* Barnum).

MESOPOTA'MIA. Two great rivers, the Tigris and the Euphrates, are the heroes in the story of Mesopotamia, where legend locates the Garden of Eden Its very name means the land between the rivers, and these powerful muddy streams have played an important part in its destiny since that far distant time when they began building up the alluvial plain whose rich acres push back the waters of the Persian Gulf.

So fertile is this river basin that the barbarian nomads roaming with their herds over the pasture lands of the Arabian Desert on the west or the uplands of what is now Iran and Turkey on the east and the north looked upon it with unending desire. Successive tribes swept down into it and fought for its possession at the beginning of history, founding their nations and falling in turn before more powerful foes. (*See* Babylonia and Assyria.)

THE OLDEST FOOTPRINT IN THE WORLD

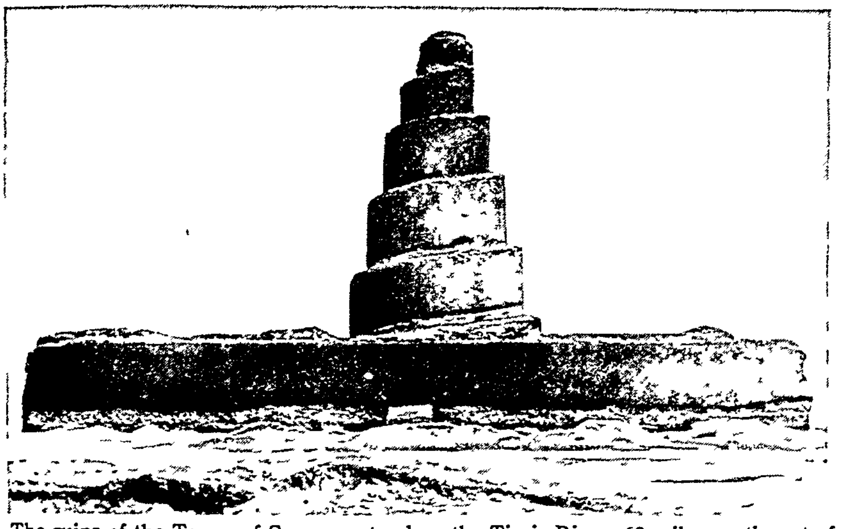
Over 4,000 years ago someone's bare foot left this clear imprint in a soft clay building brick in Ur, an ancient city in Mesopotamia.

Archeologists have found on the Plain of Shinar, at the south of the old basin, remains going back as far as 5000 B.C. In that era the Sumerians, a non-Semitic people from the east, quitted their wandering tent-living existence and settled here to till the soil, build houses, construct irrigation systems, form governments, and create a civilization—perhaps the first in the world (*see* Civilization).

These Sumerians, whose cuneiform writing on clay tablets preserved their history, made great strides in the centuries they tilled this land Their cities—Eridu, Lagash, Ur, Uruk, Larsa, and Nippur—flourished long before the dawn of history. Each of the strong Semitic desert tribes that conquered Mesopotamia during the next 2,000 years absorbed the Sumerian civilization and added to its luster as they brought under their rule the whole of the fertile crescent that circles the desert. The Akkadians excelled in sculpture. The first Babylonian Empire advanced commerce and banking, and handed the arch down to the great builders of the Assyrian Empire, whose first iron-equipped legions swept the crescent. Kish, and then Babylon, became great capitals, and fell as Assur and Nineveh gained in power. Nineveh left us the first known library. Babylon rose again after Assyria had destroyed it, rebuilt upon a far grander scale by Nebuchadnezzar, greatest of the Chaldean emperors (*see* Babylon).

About 600 B.C., the Indo-European peoples from the northern grasslands, who later conquered and settled all Europe, started to drive the Semites from this prized territory. The Medes first took Assyria, then fell before Cyrus the Great, as the Persians

THE ANCIENT TOWER OF SAMARRA



The ruins of the Tower of Samarra stand on the Tigris River, 60 miles northwest of Baghdad. A Mohammedan caliph in the 9th century patterned this 170-foot tower upon Babylon's towers, or ziggurats. Samarra is today a place of pilgrimage.

spread their empire to the Mediterranean, entering Babylon in 539 B.C. Alexander the Great died at Babylon in 323 B.C., after adding this land to his many conquests. Then Roman legions trampled the soil, but gave way in A.D. 363, before Persia, whose Sassanid kings established their capital at Ctesiphon. Finally a Semite people took Mesopotamia again in the 7th century A.D., as the Mohammedan religion swept the Arabs into world power. Their caliphs built dazzling Baghdad for their capital (*see* Baghdad).

The rise and fall of kings and nations meant little to the farmers plowing the fertile soil wet by the long irrigation canals from the two rivers. Their rich crops paid for palaces and temples and armies, but the busy people cared little who ruled, so long as the water flowed freely. The Mongol invasions began in the 13th century. Timur Leng's raid in 1393 almost depopulated Baghdad. Mongol hordes pouring in from the east destroyed the precious canals as they ravaged far and wide. The country did not pass completely into the power of the Ottoman Turks until 1638, but Mesopotamia never regained its ancient fertility, wealth, and splendor. The ruinous rule of the Ottomans lasted from 1638 until the end of the first World War, when a new nation, Iraq, was formed and Emir Faisal declared king (*see* Iraq).

MESQUITE (*mĕs-kēt'*, Spanish *mĕs-kē'tĕ*). On the arid plains of the southwestern United States, mesquite is an abundant and familiar plant. It ranges from southern Kansas to southeastern California and through Mexico to southern South America.

Mesquite is a shrub or tree, varying in height from 2 to 50 feet. Plants growing in river bottoms become large trees. In semiarid, sandy, wind-swept localities they are many-stemmed shrubs. Mesquite belongs to the mimosa group of the legume, or pea, family. Like the wild and garden sweet pea, it has butterfly-shaped blossoms. They are small, greenish-yellow in color, and are borne in cylindrical clusters two to three inches long near the ends of the branches. The flowers are followed by fleshy seed pods, or "beans," four to eight inches long, each containing 10 to 20 seeds. The twigs are armed with straight spines, some as much as four inches long. Common mesquite is also known as honey mesquite. A closely related plant called tornillo, or screw bean, is distinguished from mesquite by its tightly coiled seed pods.

Mesquite increases rapidly on overgrazed grassland and is considered a serious range pest. Control is difficult and expensive. Depending on the conditions, the plants are eradicated by power machinery, by grubbing out with a mattock, or by application of poison chemicals.

The plant has many uses, however. Its root is an important source of fuel in arid regions. The wood is used for fence posts. The foliage and pods are eaten by livestock. Mexicans and Indians make a meal cake called *pinole* from the sweet pods. The trunk of the tree yields two kinds of gum—one used for paste in confectionery and the other as a dye. The inner bark provided the Indians with material for basketry and coarse fabrics. The honey made by bees from the blossoms is valued. The bark of the root of the screw bean was used by the Indians to treat wounds.

Mesquite belongs to the subfamily *Mimosoideae* of the family *Leguminosae*. The scientific name of the common, or honey, mesquite is *Prosopis juliflora;* of the screw bean, or tornillo, *Prosopis odorata*.

HONEY MESQUITE IN BLOOM

The feathery yellow blossoms of the honey mesquite beautify the deserts of the Southwest. Bees are attracted to their nectar. Flowers are followed by bean pods relished by livestock.

METALS. Most people think of metals as being hard, workable, polishable or as conductors of heat and electricity. The qualities of metals differ widely, however. For instance, tungsten does not melt until heated to 6,098° F., but mercury, which melts at −38° F., is liquid at ordinary room temperatures. A cubic foot of lithium weighs about one half as much as a cubic foot of water, but a cubic foot of gold weighs 19 times as much as a cubic foot of water. Blast furnace iron is hard and brittle, but sodium can be cut as easily as a bar of soap.

MUCH USED METALS, THEIR ORES, AND RECOVERY PROCESSES

Metal	Symbol	Atomic Weight	Specific Gravity	Typical Ores: Name	Typical Ores: Chemical Formula	Most Used Recovery Process
Aluminum*	Al	26.97	2.7	Bauxite	$Al_2O_3 \cdot 2H_2O$	Electrolysis
Antimony*	Sb	121.76	6.684	Stibnite	Sb_2S_3	Roasting, then smelting
Beryllium	Be	9.02	1.85	Beryl	$3BeO \cdot Al_2O_3 \cdot 6SiO_2$	Electrolysis
Boron	B	10.82	2.3	Borax	$Na_2B_4O_7 \cdot 10H_2O$	Smelting
Cadmium*	Cd	112.41	8.642	Impurity in zinc ores	....	Distilling, then smelting
Copper*	Cu	63.57	8.92	Free metal Cuprite	Cu Cu_2O	Smelting or electrolysis
Gold*	Au	197.2	19.32	Free metal	Au	Smelting or amalgamation
Iron (*see* Iron and Steel)	Fe	55.85	7.86	Hematite Magnetite Limonite	Fe_2O_3 Fe_3O_4 $2Fe_2O_3 \cdot 3H_2O$	Smelting
Lead*	Pb	207.21	11.337	Galena	PbS	Roasting, then smelting
Lithium	Li	6.94	0.534	Spodumene	$Li_2O \cdot Al_2O_34SiO_2$	Electrolysis
Magnesium*	Mg	24.32	1.74	Sea water Dolomite	.... $CaMgCO_3$	Electrolysis
Manganese*	Mn	54.93	7.2	Pyrolusite	MnO_2	Smelting
Mercury*	Hg	200.61	13.546	Free metal Cinnabar	Hg HgS	Roasting
Nickel*	Ni	58.69	8.9	Garnierite	$H_2(NiMg)SiO_4$	Roasting, then smelting
Silver*	Ag	107.88	10.5	Free metal Argentite	Ag Ag_2S	Smelting or amalgamation
Tin*	Sn	118.70	7.28	Cassiterite	SnO_2	Smelting
Tungsten*	W	183.92	19.3	Wolframite	$(FeMn)WO_4$	Oxide reduced at high temperatures in contact with hydrogen, carbon, or aluminum
Uranium*	U	238.07	18.68	Uraninite	UO_3UO_2PbO	Reduced with metallic potassium
Zinc*	Zn	65.38	7.14	Sphalerite Smithsonite	ZnS $ZnCO_3$	Roasting, then smelting

*See articles on these metals.

Chemists classify about three fourths of the elements as metals because their *oxides* (a compound of pure metal and oxygen) chemically form a *base* with water. The oxides of nonmetals form an *acid* with water (*see* Acids and Alkalies). Yet this is not an absolute rule because the oxides of some metals, notably arsenic and antimony, have both basic and acid properties. Metals in solution form positive *ions* and nonmetals do not (*see* Electrochemistry).

Metals are seldom found in pure forms. Most are compounded with other elements and mixed with earth materials (*see* Minerals). These compounds and mixtures are called *ores*. In some cases many tons of ore must be treated in order to recover a small amount of pure metal. Separating metal from ore is one of the phases of the science of metallurgy. The extraction (separation) processes vary according to the form in which metal exists. Common forms are *oxides*, *sulfides*, *silicates*, *carbonates*, and *chlorides* (*see also* Oxygen; Sulfur; Silicon; Carbon; Chlorine). Other factors important in deciding the extraction process are the *stability* of the pure metal (ability to stay pure when in contact with other elements) and the *richness* of the ore (amount of the desired metal held by it).

Not all ores can be refined by a single process. Sometimes it is necessary to remove as much as possible of the undesirable materials by a preliminary process. The ore that remains is called a *concentrate*. Differences in physical and chemical properties of the crude ore are used to bring about the concentration. Most crude ores are ground into tiny particles before the concentration. If the difference is *weight* (density) the lighter particles will work to the top of the mass of crude ore and can be removed. If the difference is *solubility*, the particles that dissolve become a part of the solvent and can be separated.

There are a number of processes for refining pure metals from ores or concentrates. Those most used are *roasting*, *smelting*, *electrolysis*, *distilling*, and *amalgamation*. Most of these use high temperatures to change *solids* to *gases* (vapors) or *liquids*.

With the sulfide ores the roasting process is usually preliminary to final extraction. A relatively low temperature drives off the sulfur as a gas. Oxygen is picked up in its place. Thus roasting changes a sulfide ore to an oxide ore. The oxide ore is then melted to get rid of the oxygen. As an example, lead ore (galena) is roasted to an oxide ore, which is then melted and deoxidized in a blast furnace. Because lead melts at a lower temperature than iron, the heat of the lead blast furnace is considerably lower than that of the iron blast furnace.

Smelting uses heat to melt oxide, carbonate, and silicate ores in the presence of a *reducing agent* and a *flux*. Reducing agents are materials that combine more easily with one or more of the unwanted elements than with the metal being refined. As the reducing agent takes away some of the unwanted elements, a flux combines with the impurities that remain and the combination separates from the wanted metal.

In electrolysis a concentrated metallic compound and a flux are melted. An electric current then draws pure metal to one *electrode* (*see* Electrolysis).

Distilling uses heat to change some materials in the ore to gas. The wanted metal may be left as a residue in the heating chamber, or it too may be changed to a gas. The gas of the desired metal is condensed to a liquid and then cooled to a solid.

Amalgamation uses mercury's ability to take precious metals, such as gold or silver, into solution, thus forming an alloy. The precious metals then can be separated from the alloy by one of the other refining processes.

There are very few uses for pure metals, but many uses have been found for mixtures of two or more metals or for mixtures of metallic and nonmetallic elements. These are called alloys. Brass is an alloy of copper and zinc. Steels are alloys of iron, carbon, and other elements (*see* Alloys; Metal Working).

The WORK *of* SMITHS *of Many* AGES *and* COUNTRIES

METAL WORKING. Many thousands of years ago men pierced bits of gold for beads or hammered them into crude ornaments—probably the first use of the first metal known. Much later, but still so long ago that we cannot date it, copper was discovered and became of great use. Even today these two metals may typify the extremes of achievement in metal working—the delicate and decorative use of gold in the arts, and the severely practical use of copper in the industries of this electrical age.

Copper ushered in the Age of Metal, the beginning of a long and amazing development that has given us thousands of products, the steel framework of our skyscrapers, our locomotives, automobiles, and airplanes, and innumerable machines to make the world's goods in quantities.

Both utensils and weapons were made of copper, and when it was discovered, probably by accident, that the admixture of tin formed a hard bronze, metal working was given an impetus that has lasted until today. Bronze made excellent castings, and was used by the Assyrians, Egyptians, Cretans, Greeks, and Romans for statues and ornaments, as well as for commoner articles. Museums show an astonishing array of Bronze Age relics—chisels, ax and spear heads, decorated swords and daggers, ornamented vases and bowls, shields, and later dated mirrors, chairs, tables, statues, and portrait busts (*see* Bronze).

In later European times, metal workers produced such works of art as the tomb of Maximilian I in Vienna, with its 28 bronze statues, executed by Peter Vischer of Nuremberg; or the colossal Perseus in Florence, by Benvenuto Cellini. Ponderous church doors, great bells, candlesticks, crucifixes, shrines, altars, fonts, inkstands, door knockers, hinges, and handles were cast in bronze and worked by artists of note. Cellini, Lorenzo Ghiberti, and Michelangelo in Italy, and Germain Pilon and Jean Goujon in France distinguished themselves as consummate artists in metal.

ROMAN AND GREEK METAL WORK

The Greek drinking cup of bronze, at the top, was found near Delphi and is believed to date from the 3d century B.C. Immediately below is a Roman libation bowl, made of silver, found near Backworth in England. At the bottom, left, is a Roman cup, of heavy silver, with a bold decoration of olive leaves and fruit. At the right is a Greek mirror, of bronze, engraved with figures of Aphrodite and Pan. The handle is missing. The other side was polished for reflecting.

Brass, an alloy of copper and zinc, was little used until the Middle Ages. Then followed brass castings and *repoussé* (relief) work. Pulpits and lecterns, often topped by eagles, pelicans, or griffins in brass, massive candlesticks, and chandeliers were made for churches. Firedogs, wall sconces, locks, and utensils were made by the brass workers (*see* Brass).

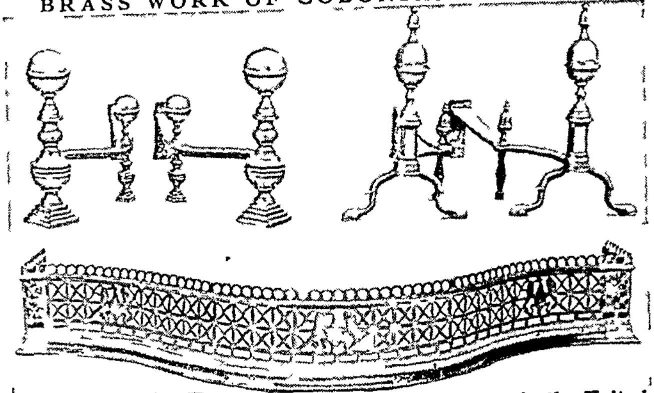
Gold and silver were used by nearly all the ancients for jewelry, coins, and vessels. Cups and jugs of the precious metals were ornamented by the Romans with scenes, figures, flowers, and conventional designs. Roman plate of later times was simpler, with border decoration chiefly.

In later times European goldsmiths produced such notable pieces as the gold cross of Justin II and Sophia in St. Peter's, Rome, the Gourdon gold chalice and paten, the chalice by Duccio of Siena, and the Cross of the Angels at Aviedo, Spain. Table service was crowded with the ornamental detail of the Renaissance, like the Cellini saltcellar made for Francis I, or of austere simplicity

like that of 18th-century Georgian England.

Lead was used by the Greeks for statuary; and the Romans used it for water pipes. English lead coffins showed fine artistry; and retainers' badges from feudal times are to be found in all museums. Probably the highest artistic employment of lead is in the English garden statuary and fountains. Lead has many uses because it is durable.

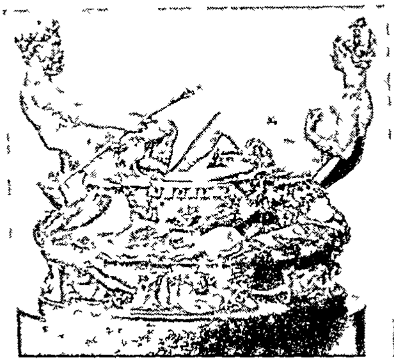
BRASS WORK OF COLONIAL AMERICA



These brasses are typical of the period preceding 1800 in the United States. The andirons, above, and the pierced brass fender, below, are colonial in design and execution.

Pewter, originally an alloy of tin and lead, but now usually of tin, copper, and antimony, became a favorite medium. The Chinese, Chaldeans, Egyptians, and Greeks probably worked with it, and it was used by the Romans during their English occupation. Durable, and yielding to shaping, it found wide use for tableware and decorative objects as early as the 14th century. Continental workers produced many beautiful plates and vessels of pewter; but British craftsmen used it more extensively. In Elizabethan times it was common for cooking utensils, flagons, communion services, and table sets.

WORK OF A MASTER GOLDSMITH



This gold saltcellar was made by Benvenuto Cellini for Francis I of France, and is now in the museum at Vienna.

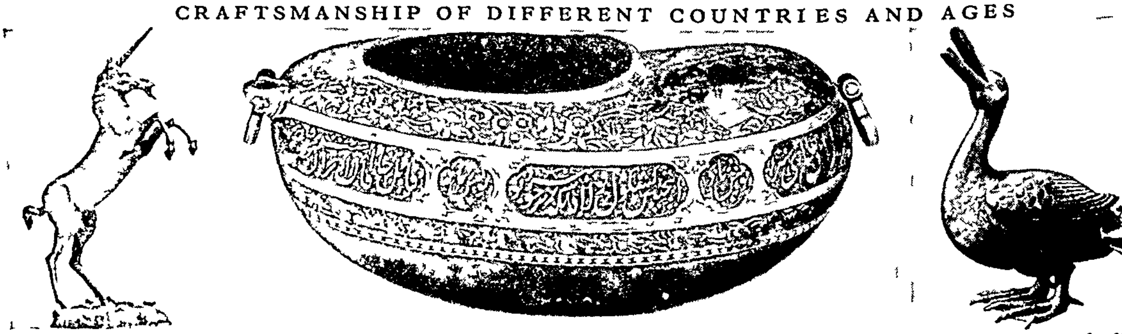
In colonial America, much of the tableware was of pewter, some of it brought from Europe, but most of it produced by colonial craftsmen. Little decoration except a slight engraving was used, the charm depending on strong outlines emphasizing utility. The heyday of the craft came between 1750 and 1850. Even plain pewter articles of this period are now valuable as antiques.

Iron responds readily to working and artistic treatment. Iron supplanted the softer bronze for weapons, and legends grew up about swords and the great smiths who made them. By the middle of the 16th century the European armorer occupied the highest place among the craftsmen, as did the Arabian armorers of four centuries before (*see* Damascus), and the Japanese armorer of the Samurai period. On his skill depended protection, freedom of movement, and appearance. With the Renaissance the trade began to die; graceful simplicity of design and nicety of construction were replaced by etching, engraving, embossing, and inlay work (*see* Armor).

Iron had other uses besides weapons and armor. It was used by the Assyrians and Egyptians; and by Roman times was in common use, for both practical and artistic purposes. In the Middle Ages, and later, we find firebacks, fireplace implements, ornate lanterns, escutcheons, candlesticks, and screens of intricate design. Massive doors with heavy iron mountings, hinges rich in ornamental design, intricate locks, and formidable knockers, add to the impressiveness of many historic buildings. Elaborate gates and grilles, such as that protecting the tomb of Edward IV in St. George's Chapel in Windsor, are found throughout Europe. Similar modern work is popular.

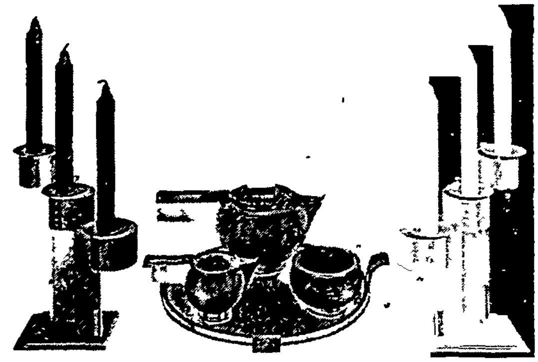
In the Orient metal work was developed with a high degree of artistry. Persian and Indian brass work is well known, and the fine tracery of damascened objects was perfected in the Orient. Unusual gold work characterizes the work of the Javanese. The Chinese produced brass and bronze art, some of

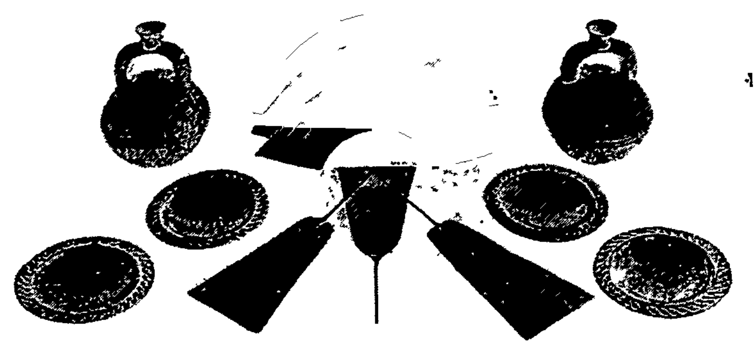
CRAFTSMANSHIP OF DIFFERENT COUNTRIES AND AGES



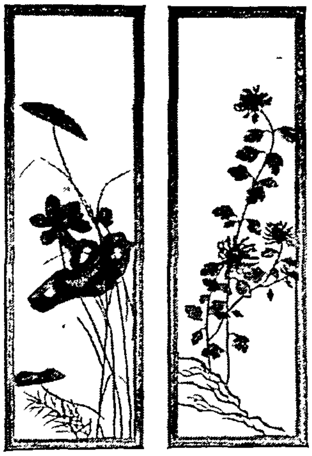
At the left is a standing cup of silver, in the form of a unicorn, made in Nuremberg in the 16th century. Bizarre cups of many odd shapes were popular at that time. In the center is a beggar's bowl from Persia, made of watered steel, inlaid with gold and bordered with texts. At the right is a bronze incense burner in the shape of a duck, made in Japan in the 17th century.

WORK IN PRECIOUS METALS BY ANCIENT AND MODERN SMITHS





At the left is some modern silver, typical of a fine type of 20th-century work. At the right are gold plates and water bottles, and gold ornaments made centuries ago by Peruvian metal workers. Below are two Chinese "iron pictures."



exceptional beauty, in many different periods, now sought by collectors. Their 17th-century iron work is most unusual, pictures being made on screens with the metal, achieving lines and effects of almost unbelievable fineness and grace.

The Japanese drew upon China in many of their artistic endeavors, but many of their techniques are their own. Iron sword guards show originality of design, while many bronze articles, particularly vases, trays, and small figures are collectors' items. Artists developed colored metallic alloys for inlay purposes, and utilized such unusual methods as cloisonné (*see* Enameling), inlays in middle relief, and decorations in high relief, sometimes cast with the object. In present-day Japan excellent work is being done in silver vases and urns, incense burners, bowls, strangely realistic metal figure groups, and in hammered metal work in low relief.

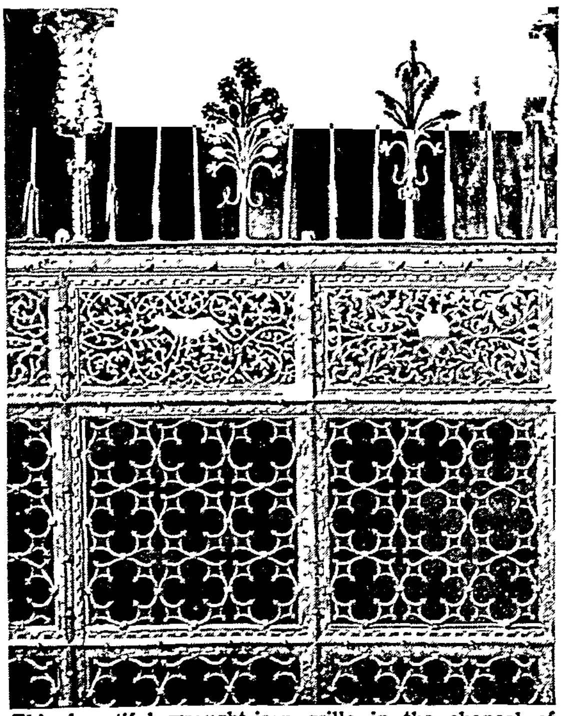
In European countries ornamental metal working still holds a prominent place. Germany put a new stimulus into silverware manufacture by working out designs that take into consideration both the limitations and capabilities of machines. It thus opened the market for sternly modern silverware that is both artistic in its essential simplicity and geometric strength, and yet radically different from designs common in hand-made ware.

Germany also startled the world with tables, chairs, and other furniture of metal, and was soon joined by the United States, which now produces even larger quantities of metal furniture using aluminum tubing, bronze, chromium plating, brass, silver, and copper.

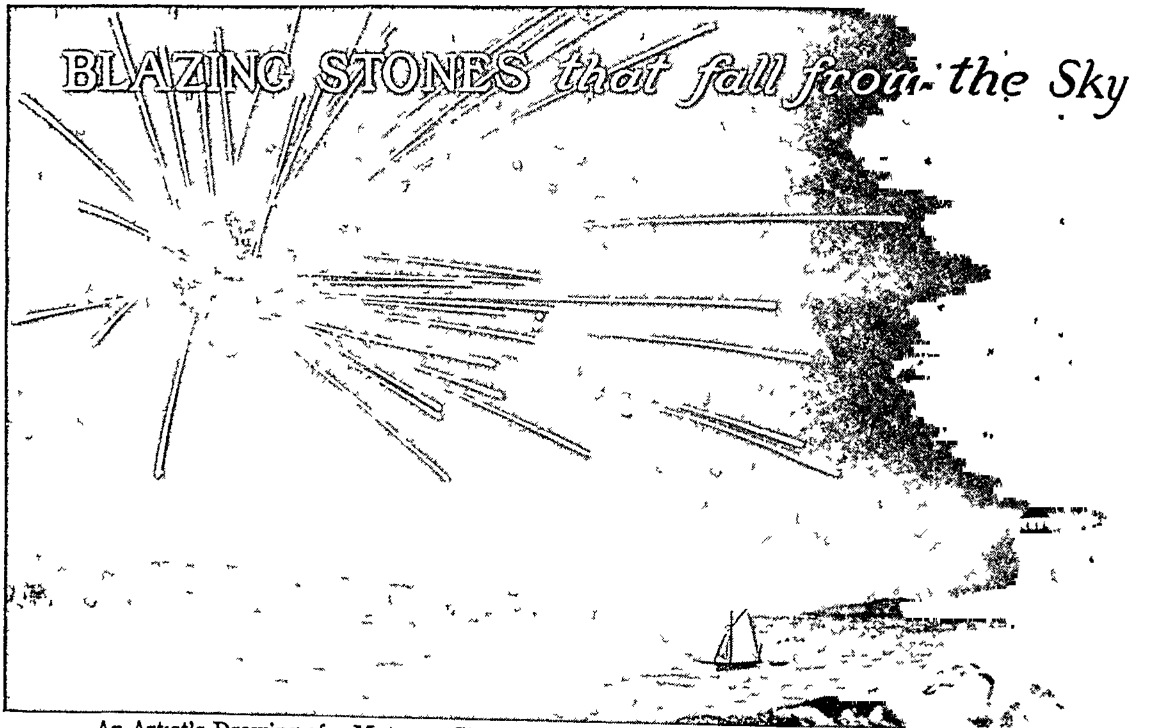
The French excel in the use of brass and copper for work of high artistic merit, such as fire screens, andirons, book ends, and mirrors. The United States has done more in striking combinations of steel with mountings of bronze, silver, and aluminum.

Today, in the industrial field, metal working uses hundreds of thousands of workers and thousands of complicated machines. Articles are formed by casting liquid metals; by extruding, spinning, drawing, forging, or rolling either hot or cold solid metals; by machining; and by pressing powdered metals into solid shapes (*see* Iron and Steel; Alloys). Pressing powdered metals is the newest process. By using more than one kind of powdered metal, alloys are formed. Among articles made of powdered metals are self-lubricating bearings, various brass, steel, and aluminum parts, screens, filters, electrical contact points, copper-carbon brushes for electric motors, radio parts, small magnets for circuit breakers, and tungsten filaments for light bulbs. New processes and lighter metals such as aluminum and magnesium for use in airplanes, automobiles, furniture, and buildings have vastly increased the metal-working field.

ORNAMENTAL GRILLE WORK OF IRON



This beautiful wrought-iron grille in the chancel of Consiglio Chapel of the Palazzo della Signoria, in Siena, Italy, was the work of Niccolo di Paolo, in 1436. It is typical of hundreds of other such pieces of craftsmanship to be found in many cities of Europe. In recent years architects have again made extensive use of hand-wrought iron, in grilles, gates, and railings.



An Artist's Drawing of a Meteoric Shower that Seems to Come from a Center Called the Radiant

Meteors and Meteorites. When we look up into the sky on a clear night, we often see a "shooting star"—a bright object which flashes swiftly across the heavens, and disappears. What is it? Where did it come from? Where did it go?

Men have asked these questions since the earliest days; but not until modern times have the answers been known. Today, however, we know that these flashes occur when bits of matter—stones, rocks, or lumps of metal—are drawn to the earth from outer space by the force of gravity. If they overtake the earth in its orbit, they may strike with a speed of some 7 miles a second; if they collide head-on, the speed may be 49 miles a second. But at either speed the object compresses and heats the air to such an extent that the object takes fire. Usually it burns completely before it can strike the earth.

Some of these bits of matter strike the earth before they can be completely consumed. Then we can learn what they contain. We call them *meteorites*, to distinguish them from the *meteors*, which burn up in the air. We know that meteors have the same material, by examining their light with a spectroscope (*see* Spectrum and Spectroscope).

Where does the matter come from? It was thrown off from the sun when the planets were formed, or was left when various heavenly bodies broke up (*see* Planets). Most bits are so small that several thousand could be held in one hand. Perhaps 20 million specks of this *cosmic dust* enter the atmosphere every day.

Meteors often travel in swarms; and a swarm striking the air causes a brilliant display called a *meteoric shower*. Some swarms travel in regular orbits through the solar system. One such swarm, called the Leonids, is encountered every year, but only once in 33 years does the earth enter it completely enough to cause a brilliant display. This happened in 1799, 1833, and 1866; but the displays in 1899 and 1933 were slight, probably because the planet Jupiter had pulled the swarm somewhat out of its regular path.

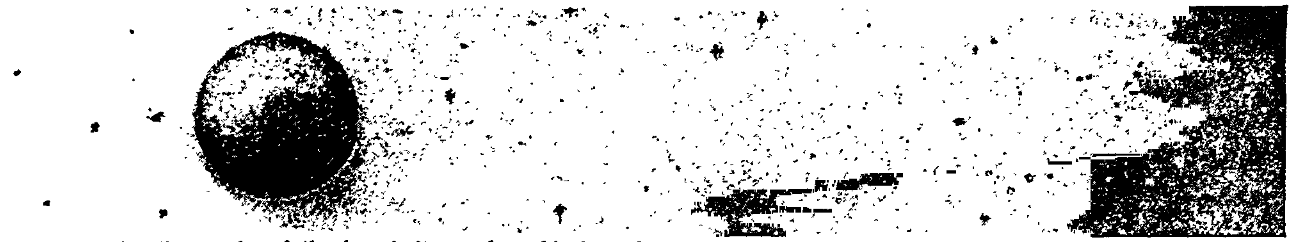
When Meteorites Hit the Earth

Enormous meteors occasionally plow deep into the earth, leaving craters to mark the point of impact In 1950 the world's largest meteor crater was discovered in northern Quebec, about 60 miles south of Hudson Strait. Chubb Crater, named for its discoverer, is about 2½ miles across, 7½ miles around, and 1,350 feet deep. The surrounding plain, of solid granite, is creased by concentric ripples 60 feet high, like those caused by a pebble dropped in water. The meteor fell some 3,000 to 5,000 years ago.

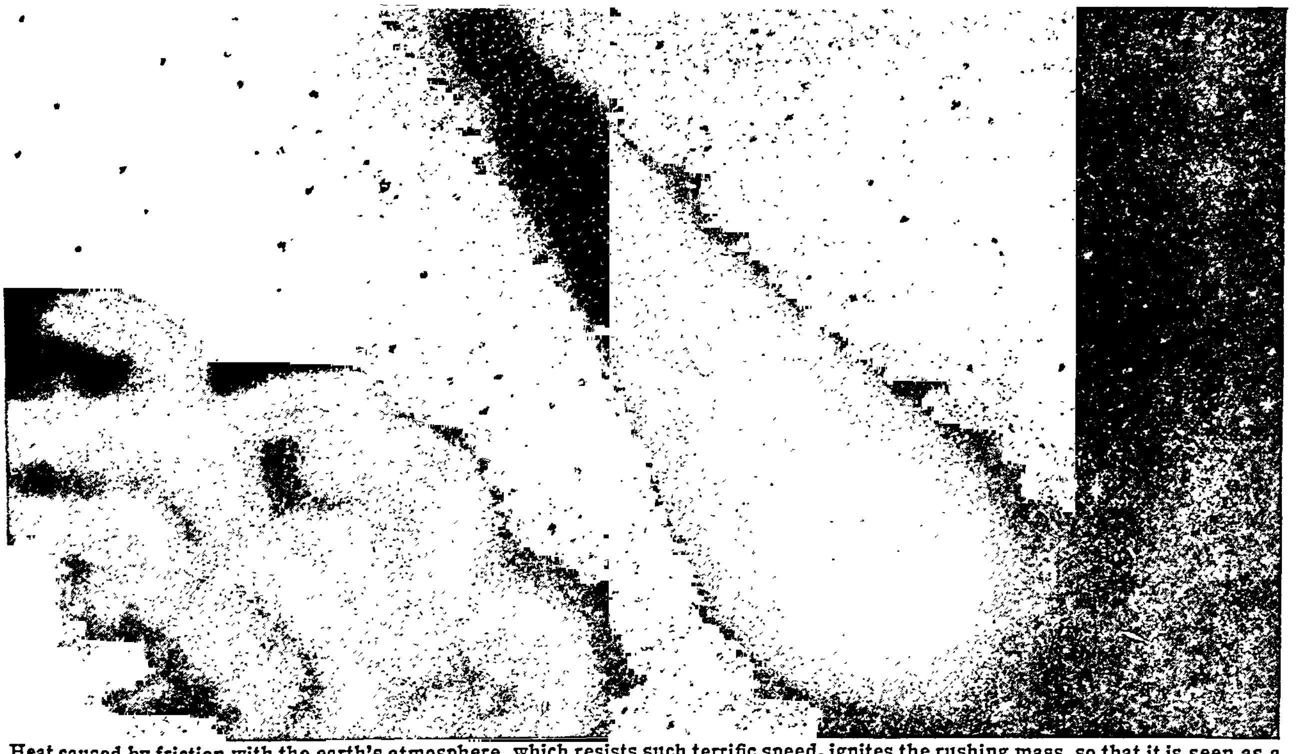
Meteor Crater, near Winslow, Ariz., is 4,150 feet across and 570 feet deep. The amount of erosion indicates that the crater is 2,000 to 5,000 years old Wolf Creek Crater, in Western Australia, found in 1947, is one-half mile across and 200 feet deep. In central Siberia, where a meteor fell in 1908, the earth was heaved in miles of waves, and trees were blasted for 25 miles around by the explosion.

Whether large or small, all meteorites are made either of stony material, or metal, or a mixture of stone and metal. The stony ones are called *aerolites*, the metal ones *siderites*, and the mixed ones *siderolites*. The principal metal found is iron, combined with nickel and traces of copper, cobalt, and rare metals. Atmospheric gaseous elements are found, but

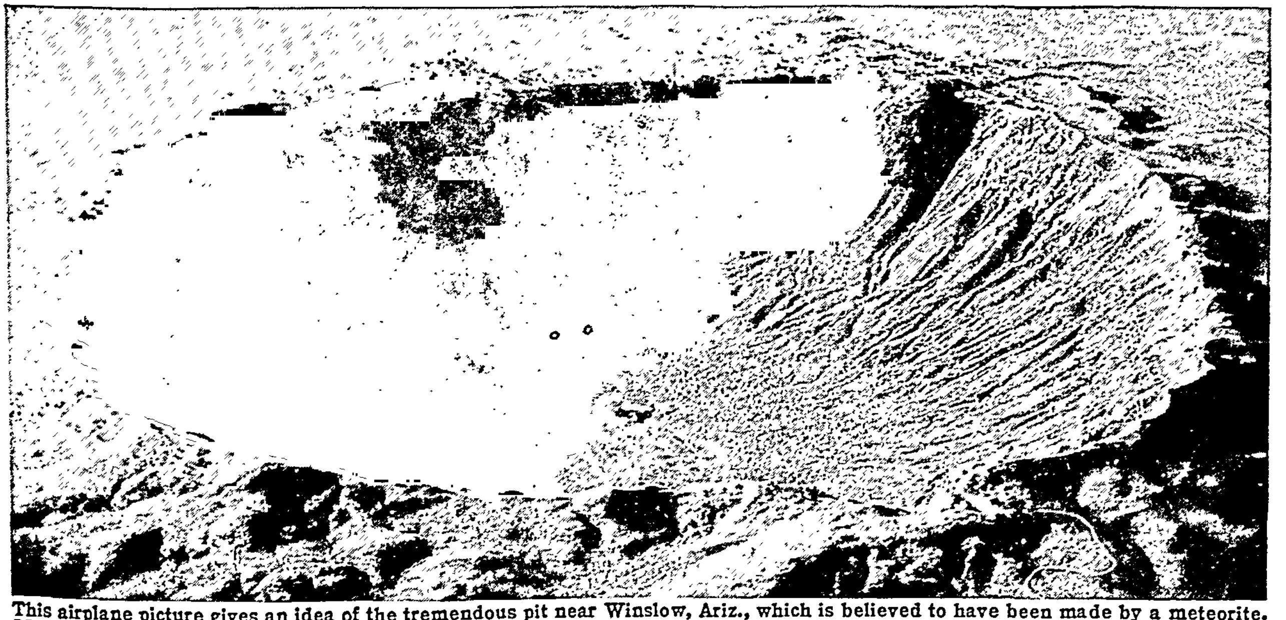
LIFE AND DEATH OF A METEORITE



A meteor ordinarily travels quietly along in its regular orbit through space, as shown above. But when it comes near a planet such as our earth it plunges headlong toward its great neighbor. Its passage across the sky is often followed by a sound like distant thunder.



Heat caused by friction with the earth's atmosphere, which resists such terrific speed, ignites the rushing mass, so that it is seen as a streak of fire (above). But the flaming trail lasts only a few seconds, for the meteor bursts against the air pressure, or buries itself in the earth. Evidence of its fiery flight is found in the glossy black crust which identifies most meteoric fragments. This appears in sharp contrast to the usual light gray interior speckled with metallic iron.



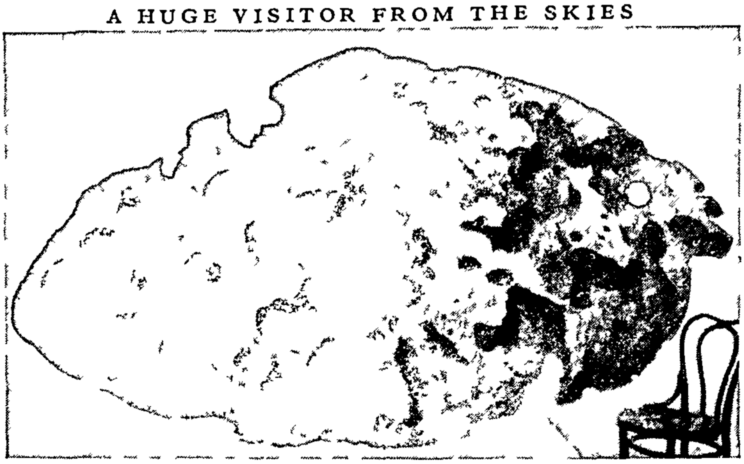
This airplane picture gives an idea of the tremendous pit near Winslow, Ariz., which is believed to have been made by a meteorite. Meteor Crater yawns four-fifths of amile wide and 570 feet deep. Its slopes are strewn with pieces of crushed boulders, and meteoric iron is scattered within a five-mile radius outside. Scientists are digging for the meteorite itself, for the mass which hollowed such a bowl may contain metals worth half a billion dollars.

no new element has been discovered. One peculiarity of meteoric iron is a special kind of crystallization which is unknown on earth.

Armor plate was first made as a result of the knowledge gained through analysis of meteorite composition. In cutting up iron meteorites it was found that those having 90 per cent of iron and about 10 per cent of nickel were very hard and extremely difficult to slice. By mixing iron and nickel in the same proportions a steel was made which was harder and tougher than any known at that time.

Meteorites have caused little damage, though it is recorded that in India a man was actually killed by one of these stones from the sky. On April 26, 1803, between 2,000 and 3,000 stones fell in France in an area of less than 30 square miles. Many have been observed and picked up in the United States. Admiral Peary, the discoverer of the North Pole, transported from Greenland a huge stone weighing 36½ tons which is thought by many to be a true meteorite. Only a guess can be made as to the number of meteorites which reach the earth in a year; it may be as few as 70 or as many as 3,000. So far as we know, these meteorites, fragments of exploded worlds, may have traveled into the solar system from the outermost depths of space. In the course of their journey towards the sun, the earth strikes across their path, and what is virtually a collision occurs.

A HUGE VISITOR FROM THE SKIES



This tremendous mass, weighing over 15 tons, fell to earth near Willamette, Oregon. The friction of the atmosphere, setting it afire, is believed to be in part responsible for the pitting of its surface, though most of the erosion was due to the rusting away of the iron contained in the meteorite as it lay in the ground after its fall. The chair beside the meteor gives you a measure of its great size.

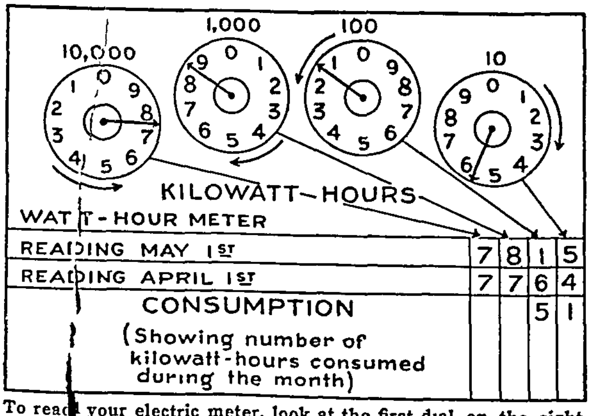
Many swarms of meteors seem to fall from a single point in the sky which is called the "radiant," and the various swarms or groups are named for the constellation in which the radiant appears to lie. Thus we have Leonids, the Perseids, the Lyrids, and the Andromedes. The Leonids are active every year in November, but other groups appear in August, April, September, and October. Planetary attraction often changes the location of the radiants

MACHINES *that* MEASURE ELECTRICITY, GAS, *and* WATER

Devices that Keep Your Accounts with the Public Service Companies—The Little Motor that Measures the Electric Current and the Bellows that Pump up the Gas Bill—Two Types of Water Meters

METERS. In the basement of a city home you will usually find two, if not three, kinds of meters, which measure the quantities of gas, electricity, and sometimes water, used on the premises.

The meter in general use for measuring electric current is called a motor-meter, for it operates somewhat like a small electric motor (*see* Electric Generator and Motor). The current consumed passes through the meter over coils of electric magnets setting up a magnetic field of force. These forces act upon a metal cylinder or disk that is free to rotate on a pivot turning a tiny shaft, just as the shaft of an electric motor is operated by similar magnetic forces. The more current used the faster it turns, so the number of its revolutions indicated on the dials measures the amount of current passed through the meter. The cylinder is pivoted on a sapphire or diamond jewel to reduce the friction as much as possible. The wearing of this jewel point causes the meter to run slow and most electric meters tested after long service are found to run slow rather than fast—a fact which may give the customer some satisfaction. The turning shaft operates the first disk and

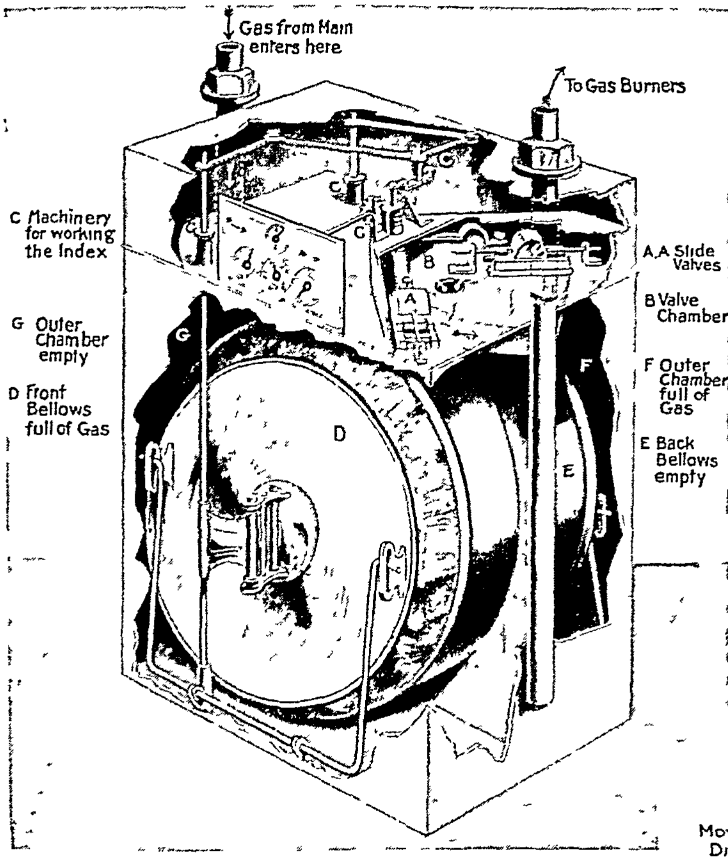


To read your electric meter, look at the first dial on the right. Set down the lower of the two figures between which the arrow is pointing (if between 9 and 0, read 9). Do the same for the other dials. Subtract from this the reading on last month's bill, and you have the number of kilowatt-hours you have used.

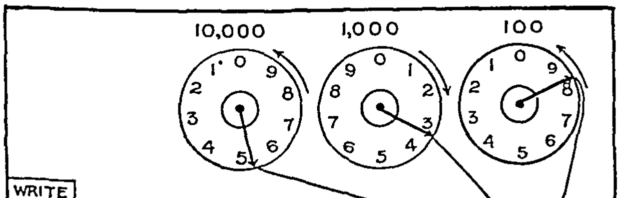
the cog-wheels operating all the disks are geared together in such a way that a revolution of the first disk will move the second a fraction of the distance around its dial and the second disk will move the third and so on, the disks registering in order units, tens, hundreds, and thousands of kilowatt-hours.

The gas meter has two gas-tight chambers each having a leather bellows arrangement. The disks of the bellows are connected in such a way that when one bellows expands the other contracts. The very best grade of leather must be used in making the bellows, and it must be frequently renewed, for in order to be gas-tight it must stand a pressure as high as 200 pounds. Gas for the burners is drawn, first from inside of one bellows, then the other. The valves are so arranged that gas from the mains is supplied to the chamber surrounding the bellows which is being emptied. The pressure in the chamber squeezes gas from the bellows the chamber contains into the burners as needed. Meanwhile the other bellows is expanding. This draws in gas from the surrounding chamber, which has been filled by the previous operation of the meter. When one bellows is empty the valves shift and reverse operations. Mechanism is provided whereby the shifting of the valves operates the small drive shaft to the cog-wheels of the dials, so that the number of revolutions indicates the number of times the measure of gas in the gas-chamber has been used by the customer and the scale on the dial shows just how many 100's, 1,000's, and 10,000's of cubic feet of gas have actually passed through.

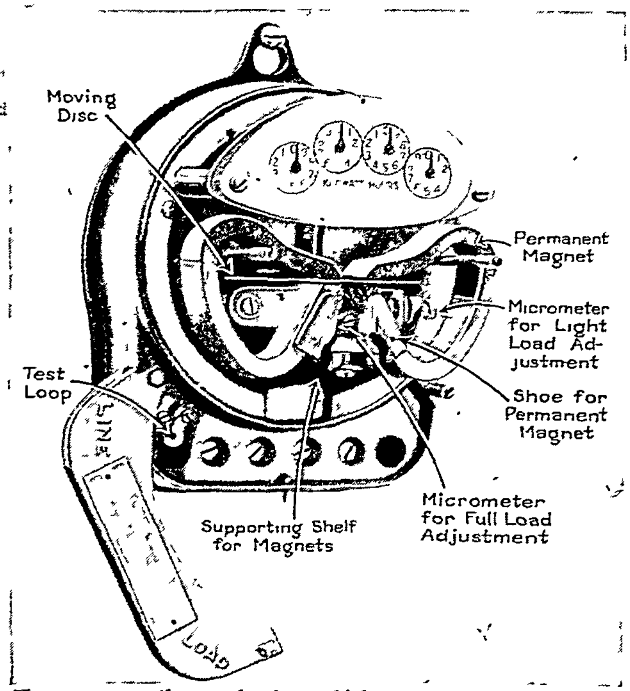
THE "INSIDES" OF A GAS METER



Gas first enters the triangular chamber (B), which is cut away to show the valves (A). The back valve (A) is open and admits gas to the back chamber (F). In this chamber is a bellows (E) with its interior connected through a valve to the pipe supplying the burners. As soon as a burner is opened, releasing gas from inside the bellows, the pressure in the chamber (F) forces the diaphragm of the bellows inward. As it moves in, it pushes out, by means of a connecting rod, the diaphragm of the front bellows (D), which now sucks in gas from the front chamber (G). This chamber, you must understand, has been filled by a previous stroke of the meter. When the back bellows has been emptied in the manner described, the back valve in the triangular chamber (B) closes, and the front valve opens, admitting gas into the chamber (G). This forces the front bellows inward, and so the pumping goes on, like a mechanical heart. The system of rods (C) records the movements of the bellows on the dials and tells you how much gas has passed through the meter. The dials, shown below, are read like those of the electric meter described on the preceding page, except that the right-hand dial shows hundreds instead of units.



WRITE DATE HERE						
5—20	READING THIS MONTH	5	3	8	0	0
4—20	READING LAST MONTH	5	2	2	0	0
	DIFFERENCE (Showing number of cubic feet of gas used during current month)		1	6	0	0



Here you see the mechanism which measures the amount of current your electric lights use every month. The current passes through electro-magnets (not visible in the picture) and rotates the horizontal disk just beneath the dials, and this disk turns the dials.

The water supply furnished to large consumers and, in some cities, to all consumers, is measured by devices which generally operate on the same principle as the gas meter. As compartments fill and empty, a shaft is turned, and dials show the number of cubic feet of water used in a given time. Another meter, especially valuable when large quantities of water are to be measured, is known as the Venturi type. This meter makes use of the fact that in a tapering pipe the pressure changes when the velocity of flow increases. The pressure, therefore, indicates the velocity; and the velocity in turn indicates the amount of water which passes in any given time. The Venturi meter is nothing but such a constricted pipe with devices which record the changing pressures at different points. Usually the record is made in terms of hundreds or thousands of gallons.

METRIC SYSTEM. Americans are accustomed to the easy decimal system of dollars, dimes, and cents, and they would not like to go back to British pounds, shillings, and pence. Yet in the measures of weight, length, and capacity there are even greater irregularities and inconveniences than in the systems of coinage (*see* Weights and Measures).

Scientific men the world over use the decimal *metric* system for weights and measures which originated in France. Many countries have adopted it for trade and commerce and all the purposes of daily life as well. In fact, the English-speaking countries are almost the only highly developed nations which have not yet adopted the metric system for all purposes.

It has been said that a man cast on a desert island with a cubic centimeter measure (two-fifths of an inch each way) graduated in millimeters could with it reconstruct all the measures of length, capacity, and weight. And he could measure with scientific accuracy everything on the island.

The fundamental metric unit of length is the *meter*, which is a little more than a yard (39.37 inches). Dividing the meter by 10, 100, and 1,000 gives the smaller units, distinguished by the Latin prefixes *deci-*, 10; *centi-*, 100; and *milli-*, 1,000. Multiplying by the same numbers gives the larger units, distinguished by the Greek prefixes *deka-*, 10; *hekto-*, 100; and *kilo-*, 1,000.

The units most used in actual measurements of length are the *millimeter* (about 1/25 inch), the *centimeter* (about 2/5 inch), the *meter*, and the *kilometer* (about 5/8 mile—3280.8 feet, to be exact). In surface measure the most common unit is the *hectare* (10,000 square meters), equal to 2.471 acres.

A hollow cube measuring 10 centimeters on each edge would hold one *liter*, the basic unit of capacity in the metric system. It is about equal to one quart—a little more than an American liquid quart and a little less than the dry quart. Like the meter, the liter is divided and multiplied by 10, 100, and 1,000 to make smaller and larger units; each of these takes the appropriate Latin or Greek prefix.

The cubic capacity of a liter is 1,000 cubic centimeters. The liter and the *hektoliter* are the units chiefly employed. Dry and liquid measures are identical in the metric system; but where the metric system is employed in commerce there is the same tendency to buy and sell by weight instead of dry measure.

The basic metric unit of weight is one gram, the weight of one *milliliter* of pure water. This unit too is divided and multiplied to make units that take the appropriate prefix. Larger units are the *quintal* (100,000 grams) and the *metric ton* (10 quintals)

The *milligram* and *centigram* are chiefly used in exact scientific work. The units most used in the ordinary transactions of life are the gram, a little more than 1/30 ounce; the *kilogram*, a little more than 2 pounds (2.2046 pounds avoirdupois); the *quintal*, about 220 pounds.

When the French National Assembly adopted the metric system in 1791, it was decided to take as the value of the meter the ten-millionth part of the distance on the earth's surface from the pole to the equator. It was hoped thus to have a natural and invariable standard from which all the values of the metric system could be recovered if by accident the physical standard should be lost—as has happened to the physical standards of some other systems. The original calculation, it has been found, was subject to a slight error. The international standard meter and kilogram are made of platinum-iridium and kept at the International Bureau of Weights and Measures near Paris.

METZ, FRANCE. The people of Metz on the Moselle River have seen many conquerors march in from the east and from the west. They have heard the measured tread of ancient Roman legions and the clatter of modern mechanized armies.

After the conquest of the Gauls, the Romans fortified Metz as a central point to resist the German tribes. In the middle of the 5th century Attila's Huns swept westward across the Rhine and plundered the town. Under Charlemagne's empire it became the chief city of Lorraine. From that time forward it became a point of dispute between French and German rulers, along with Lorraine. It withstood a long siege by Charles V in 1552. In the Franco-Prussian War (1870-71), it fell to the Germans. Though its forts held firm, hunger compelled the French under Marshal François Bazaine to surrender on Oct. 27, 1870, after a siege of more than two months. With Lorraine, Metz was returned to France in 1919 after the first World War. During the second World War, the city again fell to the Germans, but in 1944 American armies regained it for France.

Next to its forts, with their miles of underground passageways, the most notable features of Metz are its magnificent Gothic cathedral, founded in 1332, and the traces of its ancient Roman aqueducts. These contrast sharply with the modern steel mills that are supplied with iron ore from the Lorraine-Luxemburg district and with coal from the Vosges and Saar regions. The lighter industries produce shoes, textiles, and canned fruits. (*See also* Alsace-Lorraine; Franco-Prussian War.) Population (1946 census), 65,472.

MEUSE-ARGONNE (*mūz är-gôn'*), **BATTLE OF.** On the night of Sept. 25, 1918, American troops, under the command of General John J. Pershing, were ready for an intense drive in the Argonne Forest west of the Meuse River. Throughout this rocky, wooded plateau of northeastern France, in the fork of the Aisne and the Aire rivers, the Germans had placed networks of barbed wire. The entire area was subject to cross-fire from concealed German machine-gun nests or "pill-boxes"—low, concrete towers, with only a narrow firing slit. They could withstand anything but a direct hit from a shell.

West of the Aisne headwaters lay the French armies. East of the Aisne, the American troops extended to the Meuse River north of Verdun, where they were flanked by French troops under the American high command. The battle of the Meuse-Argonne was part of a gigantic pincers attack, pivoting in the region north of Soissons. In the extreme north of France, at the tip of the other jaw of the pincers, were the British armies which were to close in toward Belgium. But the Americans had the more formidable territory to conquer. Opposite them the German defenses were 14 miles deep.

Progress of the Attack

For three hours during the night of September 25–26, the American artillery kept up a continual fire. At dawn, the infantry swept over the first line of German defenses, and by September 28 the Americans had advanced from three to seven miles along the entire front. Then came a pause for bringing up supplies, repairing roads, and organizing the next drive. During this time, the celebrated "Lost Battalion" of the American army pushed so far into enemy lines that by October 2 it was surrounded, but it held out until help arrived. On October 4 the Americans overran the famous "Kriemhilde Line," a portion of the "Hindenburg Line," to which the enemy had retreated. The final stage of the battle began on November 1, with a crushing bombardment which enabled capture of the German supply center, Buzancy. The Germans fell back in disorder to Sedan. The Americans pursued, but halted on the night of November 6–7 and allowed the French to enter Sedan first, for, in that city, France had suffered a great defeat by the Germans in 1870 (*see* Franco-Prussian War). Now the Germans were asking for peace, and the Armistice was signed on November 11. (*See* World War, First.)

No such bitter struggle marked this strategic region in the second World War. In 1940, 70 German divisions crushed the French 9th Army at Sedan, and in two days seized all the battlefield of 1918. In 1944 the American 1st Army, sweeping east through France, recaptured Sedan almost unopposed.

For the Meuse-Argonne battle in 1918, the American 1st Army had 33 divisions (26 American and 7 French). The Germans used a quarter of their entire strength, 47 divisions west of the Meuse, and 15 divisions east of the Meuse. The Americans had 117,000 killed or wounded out of more than 1,000,000 men engaged. The German losses were 56,000 prisoners and about 94,000 killed and wounded. The American Divisions engaged were the 1st, 2d, 3d, 4th, 5th, 6th, 7th, 26th, 28th, 29th, 32d, 33d, 35th, 36th, 37th, 42d, 77th, 78th, 79th, 80th, 81st, 82d, 89th, 90th, 91st, and 92d.

MEUSE RIVER. This European river has often been a battle line. In 1914 the Germans took Liége on its east bank. The Americans in 1918 seized Sedan on the west bank. In 1940 the Germans crossed the Meuse in the conquest of France. Then in 1944 they were driven back over the Meuse by the Allies.

Rising in northeastern France, the Meuse flows north into Belgium. At Namur it receives its chief tributary, the Sambre, and almost doubles its volume. It then flows northeast across Belgium, and enters Holland, where it is called the Maas; sweeping in a great curve around to the west it joins the Waal, an arm of the Rhine. Finally it reaches the North Sea, about 20 miles below Rotterdam.

A most interesting feature of the Meuse is its disappearance beneath the ground for a distance of more than three miles shortly before it enters Belgium. The Meuse is in effect, though not actually, a tributary of the Rhine. The direct distance from its source to its mouth is only 230 miles, but because of its many windings it flows 560 miles in its course. Its larger tributaries (besides the Sambre) are the Ourthe, which pours in its waters at Liége, and the Roer, which joins it in southern Holland.

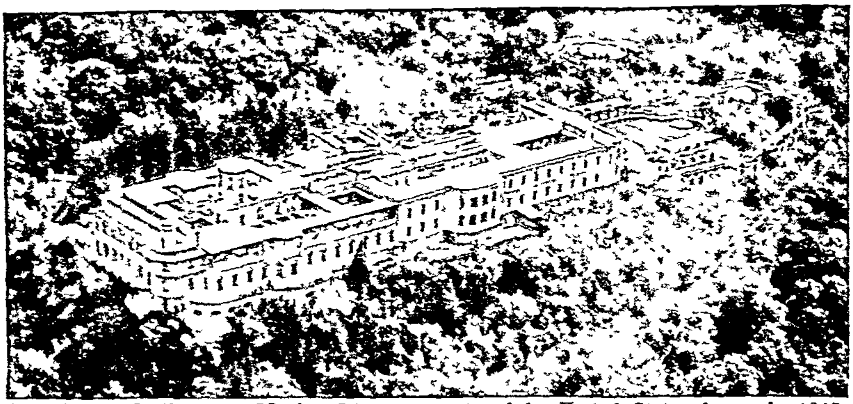
The commerce of the Meuse is probably only exceeded by that of the Rhine. A series of canals in Belgium and in Holland make it navigable for 360 miles, and another canal extending to the Saône has linked it with the great river system of France.

From the ancient days when its valley was furrowed with old Roman roads leading from Gaul to southern Germany and the Danube, the banks of the Meuse have bristled with strongly fortified towns. Here during the Middle Ages was the scene of many a desperate struggle between rival princes, towns, and social classes. Another fort was built after the Franco-Prussian War of 1870-71, to replace these relics of an early civilization. Today the names St. Mihiel, Verdun, Sedan, Namur, and Liége—all lying on its banks in France or Belgium—suggest the great wartime tragedies that this river has witnessed.

MEXICAN WAR. "Mexico has passed the boundary of the United States, has invaded our territory and shed American blood upon American soil. War exists, and, notwithstanding all our efforts to avoid it, exists by the act of Mexico herself." So President James K. Polk said in his message to Congress in May 1846.

But many Americans as well as all Mexicans disagreed with the President then and later. The trouble grew out of a dispute over the boundary of the new state of Texas, formerly a part of Mexico. The United States claimed on somewhat doubtful grounds that the southwest boundary of the state—and therefore of the United States, since Texas had been admitted to the Union—was the Rio Grande. But

HISTORIC CHAPULTEPEC CASTLE



Chapultepec Castle, near Mexico City, was captured by United States forces in 1847. For years it was the "White House" of Mexican presidents. Now it is a national museum. Its cypress trees were growing when the Aztec emperor Montezuma had a palace here.

Mexico claimed that it was the Nueces River some hundred miles to the eastward.

This dispute might have been settled amicably had it been the only trouble. But two other issues complicated the matter. In the first place many American citizens had claims against Mexico for losses of property caused by the unsettled condition of the country, and Mexico would not pay the claims; also the President wished during his administration to acquire the vast region of California, and in the campaign for his election the spirit of conquest had been skillfully inflamed by coupling the settlement of the Oregon question with the Mexican question. Polk had tried in vain to purchase California from Mexico, but that country had indignantly refused to sell its territory. And the refusal had added fuel to the flame, especially with those who wanted more land for the expansion of slavery. This last object, one which can easily be overemphasized as a cause of the war, was the one that aroused the opposition of the people of New England to the conflict. Their attitude was expressed by James Russell Lowell in the 'Biglow Papers'—

Ez fer the war, I go agin it—
I mean to say I kind o' du,—
Thet is, I mean that, bein' in it,
The best way wuz to fight it thru.

And so the American people, through Congress, voted men and money for carrying on the war.

A One-sided Conflict

In every battle in the war the American troops were victorious, though in every important engagement they were outnumbered by the Mexicans more than two to one. General Zachary Taylor with a small force was already in the disputed area when war was declared and defeated the Mexican troops at Palo Alto on May 8, 1846. Resaca de la Palma and Matamoras fell into his hands next, and then he struck boldly into the interior. After a four days' siege and a gallant resistance by the Mexicans, he entered the city of Monterrey on September 24. But his most famous victory was that of Buena Vista. There, for the entire day of Feb. 23, 1847, his army of 4,700 men successfully withstood the attack of 20,000 Mexicans under Santa Anna. The Mexicans finally acknowledged defeat by withdrawing from the field. It was a splendid victory for Taylor and one that ultimately made him president of the United States.

While these victories were being won in Mexico, Americans under Capt. John C. Frémont had taken possession of California (*see* California), and Gen. Stephen W. Kearny had secured New Mexico with practically no loss of life. These expeditions gained the territory that the United States wanted. But Mexico remained unyielding and so Gen. Winfield Scott was sent down to take the capital, Mexico City.

On March 27, 1847, Scott's force captured the seemingly impregnable fortress on the harbor of Vera Cruz and so controlled the gateway to the country. On April 18, with 8,000 men, he drove 15,000 Mexicans from the pass of Cerro Gordo (meaning Big Hill) so precipitately that President Santa Anna left his wooden leg on the battlefield.

One place after another fell into Scott's hands—Jalapa, Perote, Puebla, Contreras, Churubusco, and Molino del Rey. Finally he came to the Rock of Chapultepec (Grasshopper Hill) three miles from Mexico City. The Mexicans fought heroically in defense of this ancient fortress. But their bravery could not make up for their poor equipment, incompetent officers, and lack of organization. After a desperate struggle they were defeated. The next day, September 14, the American troops entered Mexico City and the fighting was at an end.

The Treaty of Peace

With Mexico prostrate, the demands of the American expansionists passed all bounds. Buchanan, then secretary of state, declared, "Destiny beckons us to hold and civilize Mexico." But President Polk was more moderate. By the Treaty of Guadalupe-Hidalgo (Feb. 2, 1848) Mexico accepted the Rio Grande as its boundary and gave to the United States the fairest of its northern provinces—California and New Mexico, which included parts of the present states of Nevada, Utah, Arizona, Colorado, and Wyoming. Mexico received $15,000,000 and was also relieved of all claims of citizens of the United States against it.

This outcome gave the United States vast mineral wealth, especially gold, and a door to the Pacific Ocean and the Orient. But the additional territory seemed a doubtful blessing. It raised again the burning question of slavery and the application of the Missouri Compromise to the new lands. And the questionable character of the American claims contributed a heritage of ill will to the troubled relations between the United States and its weaker neighbor.

MEXICO—*A New Nation with an* ANCIENT HERITAGE

MEXICO. The United States has only two immediate neighbors—Mexico on the south and Canada on the north. With Canada, the American people share a common language and much the same racial and historical background. They have no such direct and simple ties with Mexico. The great segment of the New World called Latin America begins at the Mexican boundary, with profound differences not only in language but also in culture and tradition (*see* Latin America). Mexico has in addition many traits that distinguish it from the other Latin American countries.

For the United States and Mexico to get along with one another, as good neighbors must, the people of the two countries need to understand the differences between them as clearly as possible. Fortunately, the story of Mexico is for Americans one of the most interesting chapters in the history of the New World.

Mexico is young as a nation—younger than the United States. But its distinctive culture is far older, for it is essentially an Indian nation. The people who lived there when the Spanish conquerors arrived were not destroyed or uprooted as were the Indians in the rest of North America. True, many of them were enslaved for a time, but in the end they merged with their conquerors and absorbed them.

From the newcomers the Mexicans took their language and their religion. But they kept most of the characteristics and many of the customs of their Indian ancestors—ancestors who, long before the white men came, had reached a high degree of social organization. In the early years of the 19th century they won their independence from Spain. Since then, partly by gradual adjustments, partly by violent revolutions, they have tried to work out a free and democratic civilization suited to their needs and their tastes.

CONFIDENT EYES ON THE FUTURE

These are typical young people of Mexico City, alert, capable, proud of their heritage. Behind them rises the ancient cathedral whose foundations were laid long before the Pilgrims landed on Plymouth Rock.

To know something of those needs and tastes is the first step toward understanding. The visitor who assumes that the Mexican people are striving toward the same way of living as the people of the United States will misjudge the country. They care less for material comforts and business efficiency than do Americans. They want more time to enjoy the simple, personal side of life—home, family, friends, pleasant conversation. By the standards of foreigners who can afford a trip to Mexico, a large number of the people seem to live in great poverty. But the poorest adobe hovel is likely to be gay with flowers and with cages of songbirds. And the people living there will meet the visitor with dignity, warmth, and kindliness.

The work of a Mexican's hands is usually a thing of art—woven baskets and blankets, hammered silver jewelry, delicately molded pottery. The very vegetables in the market place are arranged in patterns with an artist's eye for color. From this native feeling for decorative beauty comes the boldness and originality of the great Mexican painters—Diego Rivera, Orozco, Siqueiros, and others—whose work has had a world-wide influence. Throughout the nation evidences multiply of progress, extension of education, rising standards of living; but the results are never likely to be identical with those achieved in the United States. They will continue to be distinctively Mexican creations—made in Mexico for the Mexicans.

A Rugged and Beautiful Land

To know the Mexican people we must look first at the rugged and picturesque land in which they live. On the map Mexico seems dwarfed by the great land mass of the United States and Canada. But it is by no means a small country. Its area of 767,000 square miles is one-fourth that of the United States. If it

were superimposed upon the continent of Europe, it would extend from northern Denmark to as far south as the tip of Italy's boot.

Mexico is shaped like a great cornucopia. The open top of the horn borders the United States for 1,800 miles. It tapers southeastward for 1,900 miles and curls its tip around the Gulf of Mexico. At each end of the cornucopia is a great peninsula—on the northwest is the long, narrow finger of Lower California and on the southeast is the thick blunt mass of the Yucatán peninsula. The narrowest part of the mainland is the Isthmus of Tehuantepec in the far south where the Gulf of Mexico and the Pacific Ocean are only 150 miles apart.

The Three Natural Regions

The mainland as a whole may be compared to a three-story house. The first floor is a strip of lowland 10 to 100 miles wide along both the east and west

This cross section of Mexico shows the position of the three regions discussed in the text—the coastal lowlands, the outer mountain slopes, and the interior plateau.

coasts. This first floor is very hot. In the north it is desert, or near-desert. Farther south, where there is more rain, it is steaming jungle.

From the lowlands rise great mountains, 10,000 feet high. With their sheer, clifflike faces and mile-deep canyons they form barriers between the coasts and the interior of the country. On the lower slopes of these mountains, facing the cool, moist sea breezes, are banana and coffee plantations. Countless valleys notched in the mountain sides hold little villages whose people raise tropical fruits and vegetables. This is the second story, where the climate is warm but mild.

Behind the mountains, in the interior, is the third story, a lofty plateau which occupies about 30 per cent of the total area of the country. To reach the plateau from the coast (from Vera Cruz, for example), one has to climb nearly 9,000 feet over the mountains; then drop down about 2,000 feet on the other side to the plateau level.

In the north the plateau is a continuation of the high plains of Arizona, New Mexico, and western Texas. It rises from an elevation of 3,000 feet at the border of the United States to 8,000 feet near Mexico City, the capital of the country.

Mountain Ranges and Volcanoes

The mountains which enclose the plateau form a pattern like a giant wishbone. The western arm is called the Sierra Madre Occidental; the eastern arm, the Sierra Madre Oriental. In the south, just below Mexico City, the arms meet and continue down to the isthmus as a single range, the Sierra Madre del Sur (of the south). Where the ranges meet, the country is crossed from east to west by a line of volcanoes. Included among them is the snowy cone of Mount Orizaba, third highest peak in North America (18,700 feet) and Popocatépetl (17,887 feet).

Like most volcanic countries, Mexico is sometimes shaken by earthquakes The most severe occur on the Pacific side. In 1943 a new volcano, Parícutin, appeared in the state of Michoacán, west of Mexico City. It sprang up in a corn field and reached a height of 1,500 feet within a year (*see* Volcanoes).

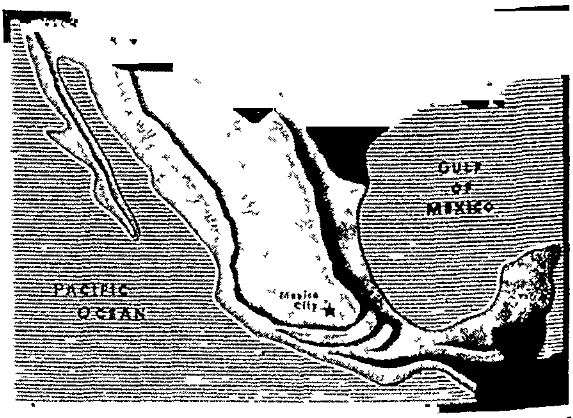
The Southeast Highlands

South of the volcanic peaks the southern Sierra Madre becomes a wild confusion of gorges and knifelike ridges. Although the general elevation is lower than on the plateau, flat places are few. The cities, like Oaxaca (*wa-ha'ka*), lie in deep valleys or, like Taxco (*tas'kō*), cling to almost vertical slopes. Many a town steps up a thousand feet from its lowest to its highest dwellings. In some villages wheeled vehicles are impractical. Only men and burros can manage to scramble up the steep paths.

The southern Sierra slopes down and ends at the Isthmus of Tehuantepec. Then beyond the isthmus the land rises again to form the highlands of Chiapas (*chy-a'pas*). These rugged highlands range along the Pacific coast and continue across the boundary of Mexico into Guatemala. On the Gulf side they fall off to a coastal plain that extends into the great curve of Yucatán (*see* Yucatán).

Where the Mexican People Live

As we have seen, mountain ranges, deserts, jungles, and swamps cover a considerable part of Mexico. Railroads and highways are few. Thousands of villages are connected with the outside world only by burro trails. Great sections of the country have no overland communication with one another. Lower California is reached from the mainland chiefly by airplane or boat, and until 1950, when a railroad was completed,



The general pattern of Mexico's principal mountain ranges is shown here. We see again how they divide the country into three regions, the largest of which is the high plateau area.

the only way to visit Yucatán from the capital was to fly across the Gulf of Mexico. Mountains, tropical rain forests, and coastal marshes lie along the way.

The Central Plateau. The heart of Mexico is the portion of the high tableland that lies in the southern apex of the two great mountain chains. It is

Lofty mountains rising from narrow coastal plains wall the great Central Plateau of Mexico. From the mainland the blunt lowland peninsula of Yucatan thrusts out into the Gulf of Mexico and the long arm of Lower California hangs down into the Pacific.

called the *mesa central* (Central Plateau). Here nearly half of the Mexican people live. The Indians who migrated into this country from the arid north hundreds of years ago named it Anáhuac, "land of lakes." Here are water, and level land for farming, and a cool, refreshing climate. The snow-crowned volcanic ranges are the source of many streams, and in the valleys lie shallow lakes and ponds. On their banks grow emerald patches of corn and wheat and the great spiky rosettes of gray-green maguey. In the high valleys lie ancient and lovely cities—Mexico City, 7,500 feet above the sea; Guadalajara at 5,000 feet, Puebla at 7,150 feet, Toluca at 8,600 feet, Morelia at 6,200 feet. This part of Mexico was densely populated before the Spanish conquest, and around the cities built by the Spaniards in the architecture of their homeland are many villages which are still purely Indian, as they were 500 years ago.

Extent.—Greatest length (northwest to southeast), more than 1,900 miles; width, from 1,800 miles along the northern boundary to 130 miles at the Isthmus of Tehuantepec. Area, 767,198 square miles (including island groups off the coast). Coast line, 1,727 miles on Gulf of Mexico and Caribbean Sea; 4,574 miles on Pacific Ocean (including Gulf of California). Population (1950 census, preliminary), 25,581,250

Natural Features.—Mountain ranges: Eastern Sierra Madre and Western Sierra Madre (highest peaks: Orizaba, about 18,700 feet; and Popocatépetl, 17,887 feet); Central Plateau, 6,000 to 9,500 feet. Principal rivers: Rio Grande, Conchos, Sonora, Yaqui, Fuerte, Lerma, Balsas, Moctezuma, Papaloapan, Grijalva, Usumacinta. Lake Chapala, 70 miles long and 20 miles wide, between states of Jalisco and Michoacán; numerous small lakes and lagoons.

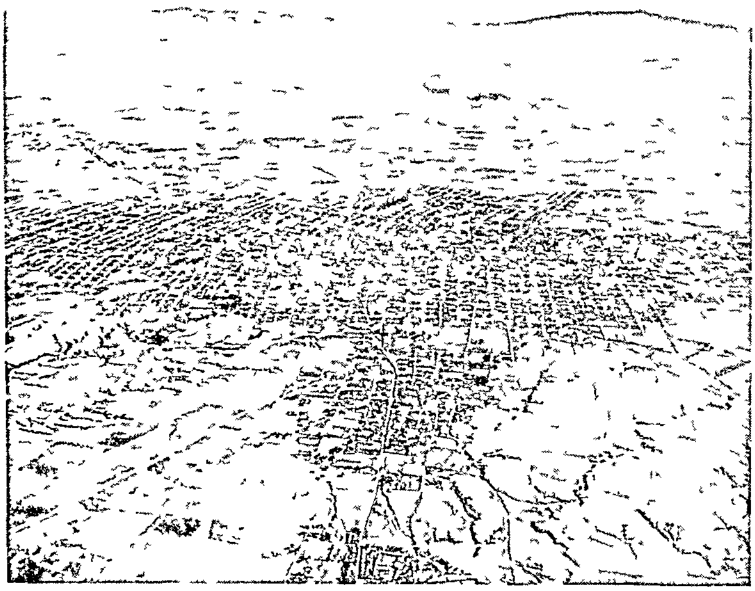
Products.—Petroleum; silver, gold, copper, lead, zinc, antimony, mercury, arsenic, graphite; corn, cotton, wheat, chick-peas, rice, sisal hemp, coffee, cacao, chicle, beans, sugar cane, tobacco, fruit; livestock; sugar and tobacco manufactures, textiles.

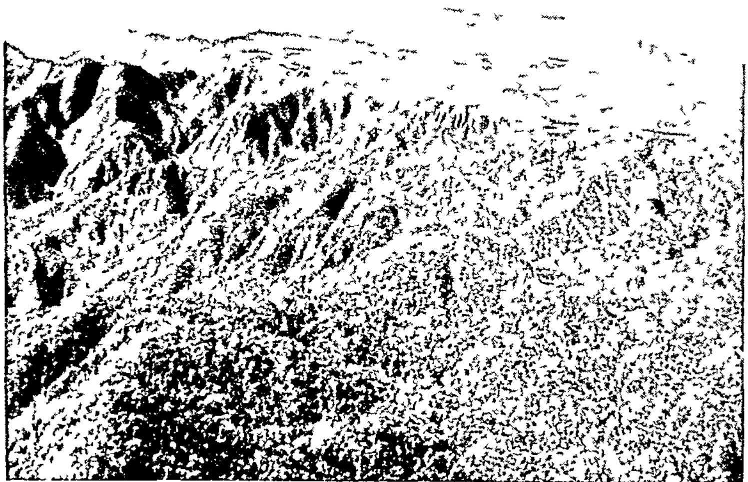
Cities.—Mexico City, capital (2,233,914); Guadalajara (378,423); Monterrey (331,771); Puebla (206,840); Mérida (144,793); Torreón (128 548); San Luis Potosí (126,596); Ciudad Juárez (122,598); León (122,585); Vera Cruz (101,469); Tampico, Aguascalientes, Chihuahua, Saltillo (over 65,000).

The Northern Plateau. About 20 per cent of the people live on the Northern Plateau. This region is lower, drier, and hotter than the Central Plateau. Most of it is a vast desert, crossed by jagged, isolated mountain blocks. Between the mountains are basin-like hollows that become lakes in the brief summer rainy season. Those around Torreón are large enough to irrigate great tracts of cotton and wheat. On this Northern Plateau are the great *haciendas*, or ranches, many thousands of acres in area, devoted chiefly to cattle raising. Minerals, however, provide the greatest wealth of the region, and most of the population is concentrated in the old mining centers of Monterrey, Durango, Zacatecas, and San Luis Potosí.

The Coastal Lowlands. The east coast as far south as Tampico is similar to the Texas gulf region and, like Texas, is rich in oil. From Tampico south to the Isthmus of Tehuantepec is a fertile, well-watered

TABLELAND AND TIMBERED MOUNTAINS





On the western edge of the Central Plateau lies Guadalajara (above), capital city of the state of Jalisco. Notice the many streams flowing between jaggedly eroded banks. These streams join the Rio Grande de Santiago to plunge 5,000 feet to the sea. The mountainous region (below) along the plateau's border contrasts with its flatness. This area with patches of level upland is covered with forests.

belt of grassland and tropical forest. When fully developed it will be one of the most productive agricultural regions in the country. Cacao, tobacco, vanilla, bananas, and coffee are cultivated. The near-by forests yield rubber, mahogany, and dye woods. Vera Cruz, on the hot, wet coast, is the country's chief seaport (*see* Vera Cruz). Inland from Vera Cruz, on the mountainside, are Córdoba (altitude 2,700 feet) and Orizaba (altitude 3,900 feet), important manufacturing and resort centers.

The west coast is very thinly populated. In the north, between the mountains and the Gulf of California is the Sonoran Desert, one of the most desolate, lifeless areas in North America. Farther south, on a plain 10 to 50 miles wide, mountain streams irrigate large cattle ranches and farms that grow fruits and vegetables. Below Cape Corrientes, on the Pacific coast, the mountains rise almost from the water's edge, and tropical jungle clothes their lower slopes. Acapulco has the only good harbor on the coast, but the country behind it is so precipitous that no railroad has ever been built into the interior. Today, with the opening of an automobile highway to Mexico City, it is one of the most popular tourist resorts in the country. Manzanillo and Mazatlán, both at the mouths of silt-laden rivers, have rail lines to the plateau.

A Vertical Climate

Mexico's climate varies, not from north to south, as in the United States, but from sea level to mountain top. As we have seen, the coasts are tropical. The hot land (*tierra caliente*) lies below 3,000 feet elevation. From 3,000 to 6,000 feet is the temperate zone (*tierra templada*), and above 6,000 feet is the cold zone (*tierra fria*). Within any one zone, seasonal changes of temperature are comparatively slight. There is greater difference between day and night than between winter and summer. In Mexico City, in the cold zone, the annual average temperature is 60.1°F. January, the coldest month, averages 54.3°; May, the warmest month, averages 65.1°—a variation of only 10.8°.

In most places, water is more precious than silver and seems less abundant. Northern Mexico, with only 10 to 20 inches of rain, is desert or semidesert. The Central Plateau, though more favored than the north, still does not have a dependable water supply. Mexico City averages only 23 inches of rain a year, most of which falls during the rainy season between June and November.

In the winter, cold air masses known as "northers" occasionally sweep down over plateau and coast, bringing frost and rain. To retain on the plateau the seasonal rains that now wash into the sea is one of Mexico's most expensive problems. Whenever effective irrigation is accomplished the country's eternal land problem will be far on the road to solution.

On the southeast coast the warm trade winds send torrents of rain crashing against the mountainsides—as much as 150 inches a year in Tabasco and Vera Cruz. Little of it reaches the plateau behind the Sierras. On the southwest coast a local summer mon-

soon interrupts the prevailing dry winds and brings moisture from the warm waters of the Pacific.

Rivers More Scenic Than Useful

Mexico has few important rivers. The majority of them are thin streams trickling and tumbling through deep gorges, called *barrancas*, carved by summer floods. The Rio Grande de Santiago plunges 5,000 feet to the Pacific through a 200-mile canyon that starts near the city of Guadalajara. In wild scenic beauty this great gorge rivals the Grand Canyon of the Colorado. The Rio Moctezuma passes through a canyon 400 miles long and hundreds of feet deep. It is one of several streams that drain the Central Plateau and then unite to form the Pánuco River, which empties into the Gulf at Tampico. The Lerma River flows across the Central Plateau to Lake Chapala, the country's largest lake (70 miles long by 20 miles wide). The Rio Balsas has opened a gulf thousands of feet deep that cuts through to the Pacific from the broken volcanic region south of Mexico City. The Grijalva and Usumacinta rivers drain the region east of the Isthmus of Tehuantepec.

Most of the streams on the Northern Plateau have no outlet to the sea and are lost by evaporation. The only important one is the Rio Grande (known in Mexico as the Rio Bravo del Norte) which forms the boundary with the United States (*see* Rio Grande).

None of Mexico's rivers is navigable for any distance above its mouth, and the canyons only add to the difficulty of unifying the land by rail and highway.

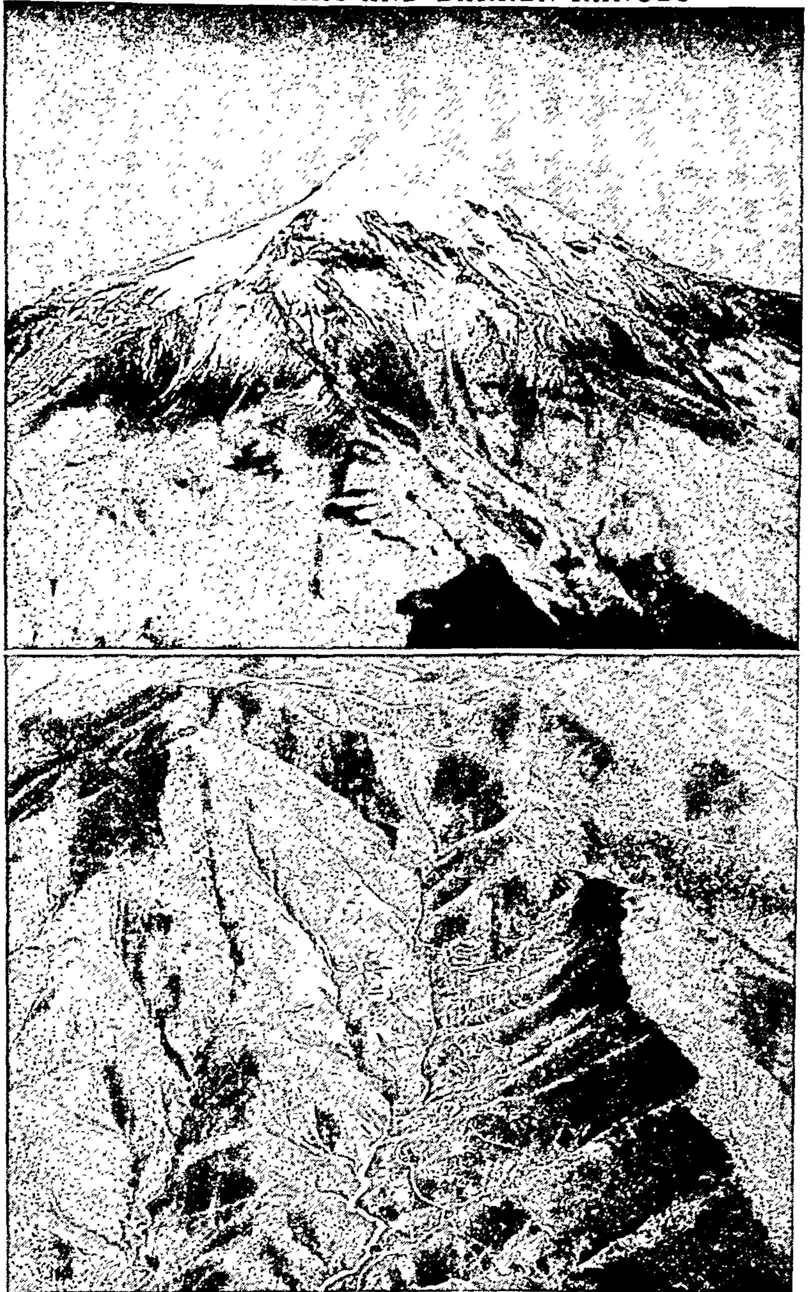
The People and Their Origins

About 60 per cent of the people of Mexico are *mestizos*, or mixed Indian and white; about 30 per cent are pure-blooded Indians; and the remaining 10 per cent are pure white. History helps to explain the dominance of the mestizos. The United States was populated by colonists and immigrants who brought their families with them. They drove out the Indians or isolated them on reservations. Mexico was exploited by a small group of adventurers who brought along few women. They came, as Cortez himself expressed it, "to get gold, not to till the soil like peasants." According to official records, less than 300,000 Spaniards entered the country during the entire colonial period. Many returned to Spain. Others married Indian women, and the first generation of mestizos was born.

Since independence was declared in 1821, the number of European immigrants to Mexico has been negligible. There was no desirable free land to attract farmers, and unskilled foreign workers could not live on what the native peon earned. Immigration laws, moreover, have always been restrictive. In colonial times non-Spanish people were not allowed to settle in Mexico. Today the law prohibits the entrance of laboring immigrants, of small investors who intend to devote their capital exclusively to commercial enterprises, and of most professional people.

With little new blood coming in, the rapidly increasing mestizos were left to possess and control the country. They now supply Mexico with most of its

RUGGED PEAKS AND BARREN RANGES



The snow-crowned volcano Mount Orizaba (above) is the highest point in Mexico and the third highest in North America (18,700 feet). In the picture below we see how the mines and mining villages perch like swallows' nests on the steep faces of the cliffs carved by swift-running streams. This rich mineral region is in the state of Zacatécas on the Northern Plateau.

THE ENDLESS LABOR OF HOME AND FIELD

Corn for tortillas is soaked in warm lime water, ground into a moist paste on a three-legged stone *metate*, and then shaped into flat round cakes and fried on a tin brazier. For centuries wooden plows have been used to cultivate the corn.

political and intellectual leaders. From them has come the gradual movement toward racial and cultural unification.

A sense of national unity has formed slowly. When the Spaniards came, some 700 distinct Indian tribes were living in Mexico, kept apart by the broken character of the land. The one unifying influence came to be the Roman Catholic church. Arriving with the conquistadors, the priests introduced among the Indians the arts of civilization and modified the brutalities of their conquerors. The insistence of the church that the Indian had a soul worth saving resulted in laws for his protection which perhaps saved him from extermination. Today more than 90 per cent of all Mexicans profess the Roman Catholic faith.

The pure-blood Indians, however, have on the whole remained in their old communities and held to their own ways of life. They still speak more than 50 different languages and dialects. Their loyalty is to the village rather than to the nation. The tribes are foreigners to one another, different in physique and character. Whatever political and economic bonds may be formed between them must be provided by the mestizos.

The 10 per cent of pure whites of Spanish descent remaining in Mexico are concentrated in Mexico City and the other large urban centers. They tend to cherish their aristocratic ancestry and to discourage the marriage of their sons and daughters to mestizos; but of necessity they merge without distinction into the business and political life of the country.

About 160,000 foreigners are residents of Mexico. The majority of them are engineers, technicians, and businessmen associated with the properties owned by foreign companies.

The population of Mexico today is about three times what it was when it won its independence in 1821. Although it has the world's highest birth rate (43.5 per thousand), it also has the second highest death rate (23.3 per thousand).

How the Mexicans Live

The typical Mexican, who makes up nearly three-fourths of the population, is a farmer. He lives in a village, as his Indian ancestors always lived, although the village has been modified in appearance by the Spanish influence.

Its center is the public square, called a *plaza*, with tree-shaded paths and gardens, benches, fountains, and bandstand. On one side stands the church. The local government buildings and the arcades of the public market also face the plaza. Often the school is here and the long water tanks where the women gather in the morning to do their laundry and chatter as they work. On market and fiesta days the drowsy, sun-patterned square leaps into life and all is color and movement.

From the square the cobblestone or dirt streets lead off into the plains or hills. The houses are half hidden behind hedges of living organ-pipe cactus, or adobe walls draped with masses of flowering vines—scarlet and purple bougainvillea, roses, lemon yellow alamanda, or other gay blossoms.

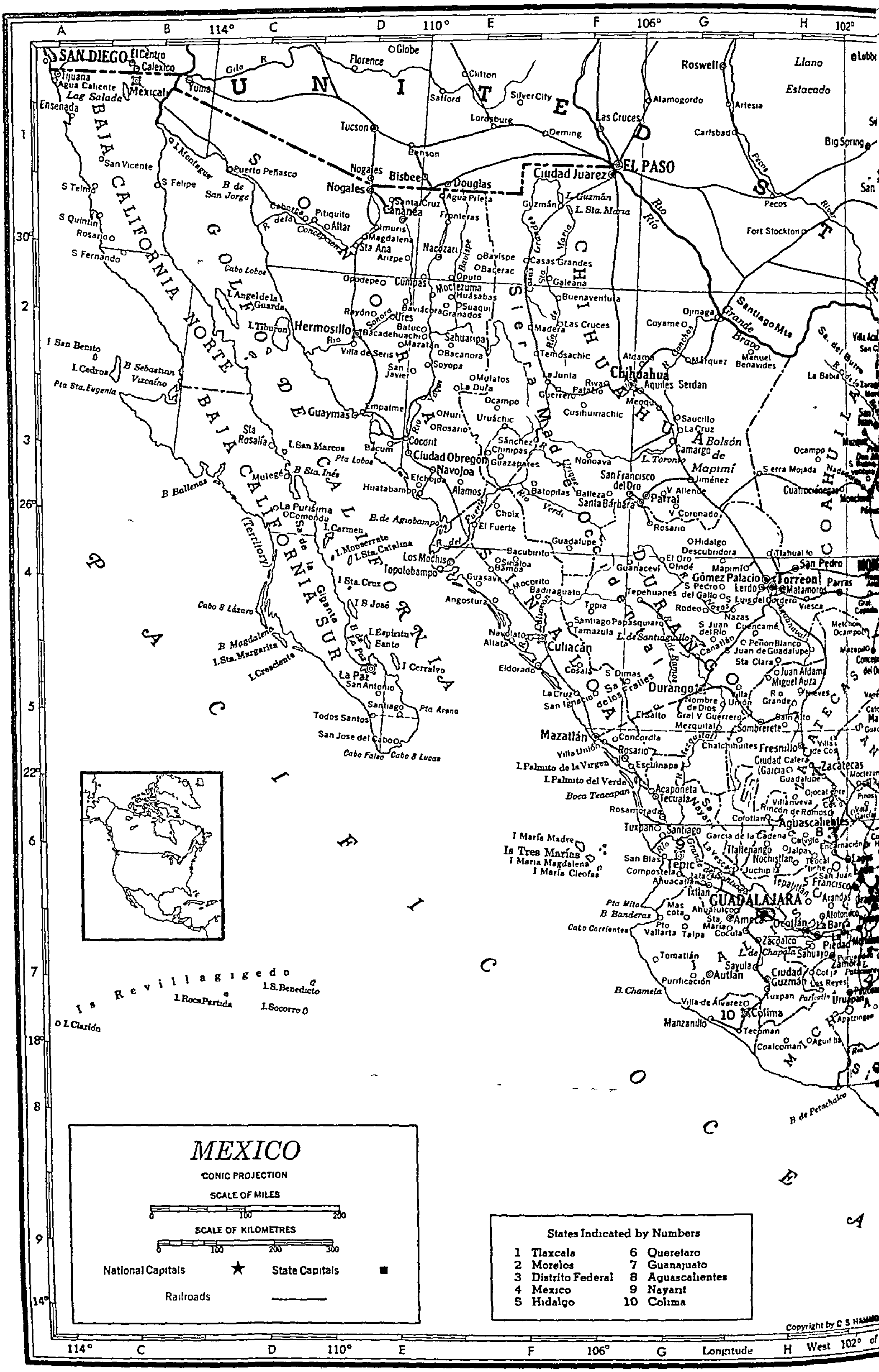
The poorest home is a one-room, windowless, floorless hut of stone or adobe brick with a thatch roof. In the lowlands the house is made of bamboo, or of stones and brush. The more prosperous home consists of several buildings with red tile roofs, grouped about a courtyard and enclosed within a wall.

The family sleeps on woven straw mats called *petates* or, in the lowlands, in hammocks. Cooking is done in the courtyard over a simple charcoal brazier. The staple food is the *tortilla*, a flat cake made of corn meal. One of the most characteristic of all Mexican sounds—as universal as the silvery chime of the

MEXICO*

Acámbaro	23,038	J 7
Acaponeta	7,111	G 5
Acapulco	28,790	J 8
Acatlán	5,591	K 7
Acatzingo	4,403	N 2
Acayucan	5,143	M 8
Actizayanca	1,165	N 1
Actopan	1,214	Q 1
Agiobampo (bay)		E 3
Agua Caliente		A 1
Agua Prieta	10,479	E 1
Agualeguas	2,471	J 3
Aguanaval (river)		H 4
Aguascalientes	93,432	H 6
Aguascalientes (state)	188,098	H 6
Aguililla	2,311	H 7
Ahuacatlán	2,666	G 6
Ahualulco	6,433	G 6
Ajuchitlán	2,656	J 7
Alacrán (reef)		P 5
Álamo	2,977	L 6
Álamos	2,921	E 3
Alaquines	864	J 5
Aldama (*Chihuahua*)	2,818	G 2
Aldama (*Tamaulipas*)	1,559	L 5
Aljojuca	2,427	O 1
Allende (*Coahuila*)	5,613	J 2
Allende (*Nuevo León*)	1,296	J 4
Almoloya	2,702	L 1
Altamira	1,387	K 5
Altamirano (Ciudad Altamirano)	4,046	J 7
Altar	1,137	D 1
Altata	115	E 4
Altotonga	4,478	P 1
Alvarado	5,776	M 7
Alvaro Obregón (Frontera)	7,439	N 7
Amatlán	2,036	P 2
Amealco	1,729	K 6
Ameca	13,589	H 6
Amecameca	7,573	L 1
Amozoc de Mota	3,810	N 2
Ángel de la Guarda (isl.)		C 2
Angostura	1,241	E 4
Antiguo Morelos	683	K 5
Apam	4,972	M 1
Apatzingán	2,080	J 7
Apizaco	12,698	N 1
Aquiles Serdán	7,368	G 2
Arandas	7,254	H 6
Arcas (cay)		N 6
Arena (point)		E 5
Arenas (cay)		O 5
Arizpe	1,126	D 1
Arramberri	1,057	J 5
Arrecife = reef (*Spanish*)		
Arriaga		N 8
Atlixco	15,606	M 2
Atotonilco	11,038	H 6
Atoyac	2,147	J 8
Atoyac (river)		N 2
Autlán	11,356	G 7
Ayutla	2,519	K 8
Azcapotzalco	48,650	L 1
Azoyú	2,178	K 8
Babia (river)		J 2
Bacadehuachi	1,053	D 2
Bacalar	619	P 7
Bacalar (lake)		P 7
Bacanora	990	E 2
Bacerac	950	E 1
Bacubirito	469	F 4
Bacum	1,624	D 3
Badiraguato	753	F 4
Baja California Norte (state)	226,861	C 2
Baja California Sur (terr.)	60,447	C 3
Balancán	1,703	O 8
Ballenas (bay)		C 3
Balleza	964	F 3
Balsas (river)		J 7
Bamoa	333	F 4
Banderas (bay)		G 6
Barra = reef (*Spanish*)		
Batopilas	738	F 3
Batuc	1,112	E 2
Baviácora	1,287	E 2
Bavispe	887	E 1
Bavispe (river)		E 1
Blanco (river)		Q 2
Boca = inlet (*Spanish*)		
Bolonchenticul	1,242	P 7
Bolsón = depression (*Span.*)		
Bravo (river)		G 2
Buenaventura	2,122	F 2
Burgos	636	K 4
Burro (mts.)		J 2
Caborca	2,321	C 1
Cadereyta (*Nuevo León*)	4,179	K 4
Cadereyta (*Querétaro*)	1,249	K 6
California (gulf)		D 3
Calkiní	4,491	O 6
Calpulálpam	3,948	M 1
Calvillo	3,486	H 6
Camargo (*Chihuahua*)	11,942	G 3
Camargo (*Tamaulipas*)	1,271	K 3
Campeche	31,274	O 7
Campeche (state)	122,087	O 7
Campeche (gulf)		N 7
Campeche (bank)		P 5
Cananea	18,037	D 1
Canatlán	3,450	G 4
Candela (*Coahuila*)	2,334	J 3
Candelaria (river)		O 8
Cárdenas (*S. Luis Potosí*)	11,228	K 6
Cárdenas (*Tabasco*)	2,891	N 8
Carmen	11,592	N 7
Carmen (island)		D 3
Casas Grandes	1,126	F 1
Casas Grandes (river)		F 1
Catemaco	5,374	M 7
Catoche (cape)		Q 6
Catorce	753	J 5
Cedral	3,543	J 5
Cedros (island)		B 2
Celaya	34,415	J 6
Celestún	872	O 6
Cerralvo	2,732	J 3
Cerralvo (island)		E 4
Cerritos	6,980	K 5
Chalchihuites	3,816	G 5
Chalco de Díaz	3,609	M 1
Chamela (bay)		G 7
Champotón	2,071	O 7
Chapala (lake)		H 6
Chapulco	1,172	O 2
Charcas	6,081	J 5
Chetumal	4,672	Q 7
Chetumal (bay)		P 8
Chiapa	5,450	N 8
Chiapas (state)	904,588	N 8
Chiautempan	4,762	N 1
Chichen Itzá (ruins)		P 6
Chichiquila	1,148	O 1
Chicoloapan	2,135	M 1
Chietla	3,285	M 2
Chignahuapan	4,156	N 1
Chignautla	3,368	N 1
Chihuahua (state)	845,033	F 2
Chihuahua	86,962	G 2
Chilapa	6,094	K 8
Chilón		N 8
Chilpancingo	12,661	K 8
China	1,622	K 4
Chinipas	761	E 3
Chixoy (river)		O 8
Choix	1,462	E 3
Cholula	11,617	M 1
Citlaltepetl (Orizaba) (mt.)		O 2
Ciudad Altamirano (Altamirano)	4,046	J 7
Ciudad Calera	4,092	H 5
Ciudad de las Casas (San Cristóbal)	17,449	O 8
Ciudad Doctor Hernández Álvarez (González)	5,737	J 6
Ciudad García	10,397	H 5
Ciudad Guzmán	23,639	H 7
Ciudad Juárez	122,598	F 1
Ciudad Madero	41,110	L 5
Ciudad Mante (Juárez)	21,293	K 5
Ciudad Obregón	30,563	E 3
Ciudad Serdán	7,791	O 2
Ciudad Victoria	31,807	K 5
Clarión (island)		B 7
Coahuila (state)	719,518	H 3
Coalcomán	2,994	H 7
Coatepec	13,755	P 1
Coatzacoalcos (Puerto México)	19,501	M 7
Cocorit	2,088	E 3
Cocula	7,706	G 6
Coixtlahuaca	2,596	L 8
Colima	28,658	H 7
Colima (state)	112,375	G 7
Colón	2,045	K 6
Colotlán	5,093	H 5
Comalcalco	3,364	N 7
Comitán	11,760	O 8
Comondú	540	D 3
Compostela	3,144	G 6
Concepción (river)		D 1
Concepción del Oro	4,847	J 4
Conchos (river)		G 2
Concordia	2,470	G 5
Córdoba	32,750	P 2
Corrientes (cape)		F 6
Cosalá	1,911	F 4
Cosamaloapan	3,740	M 7
Cosautlán	1,888	P 1
Coscomatepec de Bravo	5,266	P 2
Cosío	954	H 5
Cosoleacaque	3,237	M 7
Cotija	4,567	H 7
Cotoxtla (river)		Q 2
Coyame	501	G 2
Coyoacán	45,893	L 1
Coyotepec	4,159	L 1
Coyuca	1,989	J 7
Coyutla	4,363	L 6
Cozumel	2,085	Q 6
Cozumel (island)		Q 6
Cresciente (island)		D 5
Cruillas	656	K 4
Cuatrociénegas	2,783	H 3
Cuautitlán	816	L 1
Cuautla	6,431	L 2
Cuencamé	2,151	H 4
Cuernavaca	30,607	L 2
Cuicatlán	1,894	L 8
Cuitlahuac	1,799	P 2
Cuitzeo (lake)		J 7
Culiacán	48,983	F 4
Culiacán (river)		F 4
Cumpas	6,189	D 2
Cunduacán	2,167	N 7
Cusihuiriáchic	1,131	F 2
Cuyoaco	5,174	O 1
Delgada (point)		L 7
Descubridora		G 3
Distrito Federal	3,012,434	K 7
Doctor Arroyo	2,912	K 5
Dolores Hidalgo	5,915	J 6
Don Martín (reservoir)		J 3
Durango (state)	627,943	G 4
Durango	59,498	G 4
Dzitbalché	3,514	P 6
Ebano	2,696	K 5
Ejutla	3,942	L 8
El Fuerte	2,936	E 3
El Oro (*Durango*)	1,860	G 4
El Oro (*México*)	8,638	K 7
El Plan		M 8
El Salto	6,070	G 5
Eldorado	4,728	F 4
Empalme	10,385	D 2
Encarnación	5,978	H 6
Ensenada	18,137	A 1
Escuinapa	5,864	G 5
Escuintla		N 9
Españita	631	M 1
Espíritu Santo (island)		D 4
Espita	4,504	Q 6
Etchojoa	1,505	E 3
Falso (cape)		D 5
Felipe Carillo Puerto	652	P 7
Frailes (mts.)		G 4
Fresnillo	29,908	H 5
Frontera (Alvaro Obregón)	7,439	N 7
Fronteras	697	E 1
Fuerte (river)		E 3
Galeana (*Chihuahua*)	797	F 1
Galeana (*Nuevo León*)	1,782	J 4
García	8,775	H 5
García de la Cadena	1,503	H 6
General Bravo	1,225	K 4
General Cepeda	3,383	J 4
General Magdaleno Cedillo	2,804	J 5
General Vicente Guerrero	4,980	G 5
Giganta (mts.)		D 4
Gómez Palacio	45,872	G 4
González (Ciudad Dr. Hernández Álvarez)	5,737	J 6
González	1,126	K 5
Granados	1,142	E 2
Grande (river)		N 8
Grande (river)		G 2
Grande de Santiago (riv.)		G 6
Grijalva (river)		N 7
Guadalajara	378,423	H 6
Guadalupe (*Chihuahua*)	1,214	F 3
Guadalupe (*S.L. Potosí*)	974	J 5
Guadalupe (*Zacatecas*)	4,133	H 5
Guanaceví	2,512	G 4
Guanajuato	23,390	J 6
Guanajuato (state)	1,324,669	J 6
Guasave	4,997	E 4
Guaymas	18,816	D 3
Guazapares	317	E 3
Güemes	663	K 5
Guerrero (state)	915,400	J 8
Guerrero (*Chihuahua*)	1,023	F 2
Guerrero (*Tamaulipas*)	1,786	K 3
Guzmán	52	F 1
Guzmán (lake)		F 1
Halachó	4,112	O 6
Hecelchakán	3,358	O 6
Hermosillo	43,522	D 2
Herrero (point)		Q 7
Hidalgo (state)	849,991	K 6
Hidalgo (*Durango*)	538	G 3
Hidalgo (*Tamaulipas*)	1,194	K 4
Holbox (island)		Q 6
Hondo (river)		P 7
Hopelchén	1,089	P 7
Huajuápam	4,275	L 8
Huamantla	7,287	N 1
Huaquechula	1,433	M 2
Huásabas	863	E 2
Huatabampo	5,643	D 3
Huatlatlauca	1,124	N 2
Huatusco de Chicuellar	6,539	P 2
Huauchinango	5,779	L 6
Huautla	3,314	L 7
Huehuetlán	2,453	M 2
Huejotzingo	4,904	M 1
Huejutla	4,322	K 6
Huetamo	4,794	J 7
Hueyotlipan	1,444	M 1
Huimanguillo	2,491	N 8
Huitzuco	3,946	K 7
Huixquilucan	1,666	L 1
Huixtla	10,210	N 9
Hunucmá	4,655	O 6
Ignacio de la Llave	1,841	Q 2
Iguala	19,415	K 7
Imuris	934	D 1
Indé	1,482	G 4
Irapuato	49,426	J 6
Isla Mujeres	557	Q 6
Iturbide	668	P 7
Ixcatlán	1,759	L 8
Ixmiquilpan	1,543	K 6
Ixtapalapa	17,335	L 1
Ixtenco	4,356	N 1
Ixtepec	10,817	L 8
Ixtla	2,470	L 2
Ixtlán	4,720	G 6
Izamal	5,305	P 6
Izúcar de Matamoros	10,599	M 2
Jala	2,727	G 6
Jalacingo	2,357	P 1
Jalapa (*Tabasco*)	1,010	N 8
Jalapa (*Veracruz*)	51,123	P 1
Jalisco (state)	1,747,168	H 6
Jalpa (*Tabasco*)	2,906	N 7
Jalpa (*Zacatecas*)	3,085	H 6
Jalpan	1,317	K 6
Jáltipan	4,547	M 8
Jamiltepec	2,141	K 8
Jantetelco	1,021	L 2
Jaumave	1,839	K 5
Jesús María (reef)		L 4
Jico	5,804	P 1
Jilotepec	1,359	K 7
Jiménez	5,175	G 3
Jojutla	4,451	L 2
Jonacatepec	2,152	M 2
Jonuta	1,053	N 7
Juan Aldama	5,506	H 4
Juárez	1,024	J 3
Juárez (Ciudad Mante)	21,293	K 5
Juchipila	2,821	H 6
Juchique de Ferrer	529	Q 1
Juchitán	13,817	M 8
Juquila	1,405	L 8
Justlahuaca	4,898	K 8
La Babia	47	H 2
La Barca	13,855	H 6
La Concordia		N 9
La Cruz (*Chihuahua*)	776	G 3
La Cruz (*Sinaloa*)	1,618	F 5
La Dura	30	E 2
La Junta	901	F 2
La Paz	13,081	D 5
La Piedad	17,841	H 6
La Purísima	598	D 3
La Trinitaria		N 9
La Yesca	453	G 6
Lagos	13,257	J 6
Lampazos	2,820	J 3
Las Cruces	713	F 2
Las Vigas	3,888	P 1
León	122,585	J 6
Lerdo	13,389	H 4
Lerma	1,174	L 1
Libres	1,403	N 1
Linares	13,496	K 4
Llera	1,050	K 5
Lobos (cape)		C 2
Lobos (point)		D 3
Los Mochis	21,491	E 4
Los Reyes	5,452	H 7
Lower California (Baja Cal.) (peninsula)	287,308	C 3
Loxicha	622	L 9
Macuala (Salada) (lagoon)		A 1
Madera	4,549	F 2
Madre (lagoon)		L 4
Madre del Sur (mts.)		J-L 8
Madre Occidental (mts.)		F 3
Madre Oriental (mts.)		J 4
Magdalena	4,249	D 1
Magdalena (bay)		C 4
Maldonado (point)		K 8
Malpaís	2,100	O 1
Mamantel	183	O 7
Manuel Benavides (San Carlos)	779	G 2
Manzanillo	13,036	G 7
Mapastepec		N 9
Mapimí	2,204	G 4
Mapimí (depression)		G 3
Mar = sea (*Spanish*)		
María Cleófas (island)		F 6
María Madre (island)		F 6
María Magdalena (isl.)		F 6
Márquez		G 2
Mascota	4,237	G 6
Matamoros (*Coahuila*)	10,146	H 4
Matamoros (*Tamaulipas*)	45,776	L 4
Matehuala	14,186	J 5
Matías Romero	4,495	M 8
Maxcanú	3,586	O 6
Mazapil	1,699	J 4
Mazatán	657	E 2
Mazatlán	41,470	F 5
Medellín	581	Q 2

*Population figures from 1950 census, preliminary. These are the latest official census figures available.



MEXICO
CONIC PROJECTION
SCALE OF MILES
SCALE OF KILOMETRES
National Capitals
State Capitals
Railroads
States Indicated by Numbers
1 Tlaxcala
2 Morelos
3 Distrito Federal
4 Mexico
5 Hidalgo
6 Queretaro
7 Guanajuato
8 Aguascalientes
9 Nayarit
10 Colima
BAJA CALIFORNIA NORTE
BAJA CALIFORNIA SUR
GOLFO DE CALIFORNIA
SONORA
CHIHUAHUA
SINALOA
DURANGO
PACIFIC OCEAN
SAN DIEGO
EL PASO
Ciudad Juarez
Hermosillo
Guaymas
Chihuahua
Culiacán
Mazatlán
Durango
Torreon
Zacatecas
Aguascalientes
Tepic
GUADALAJARA
Colima
La Paz
Is Revillagigedo
Is Tres Marías
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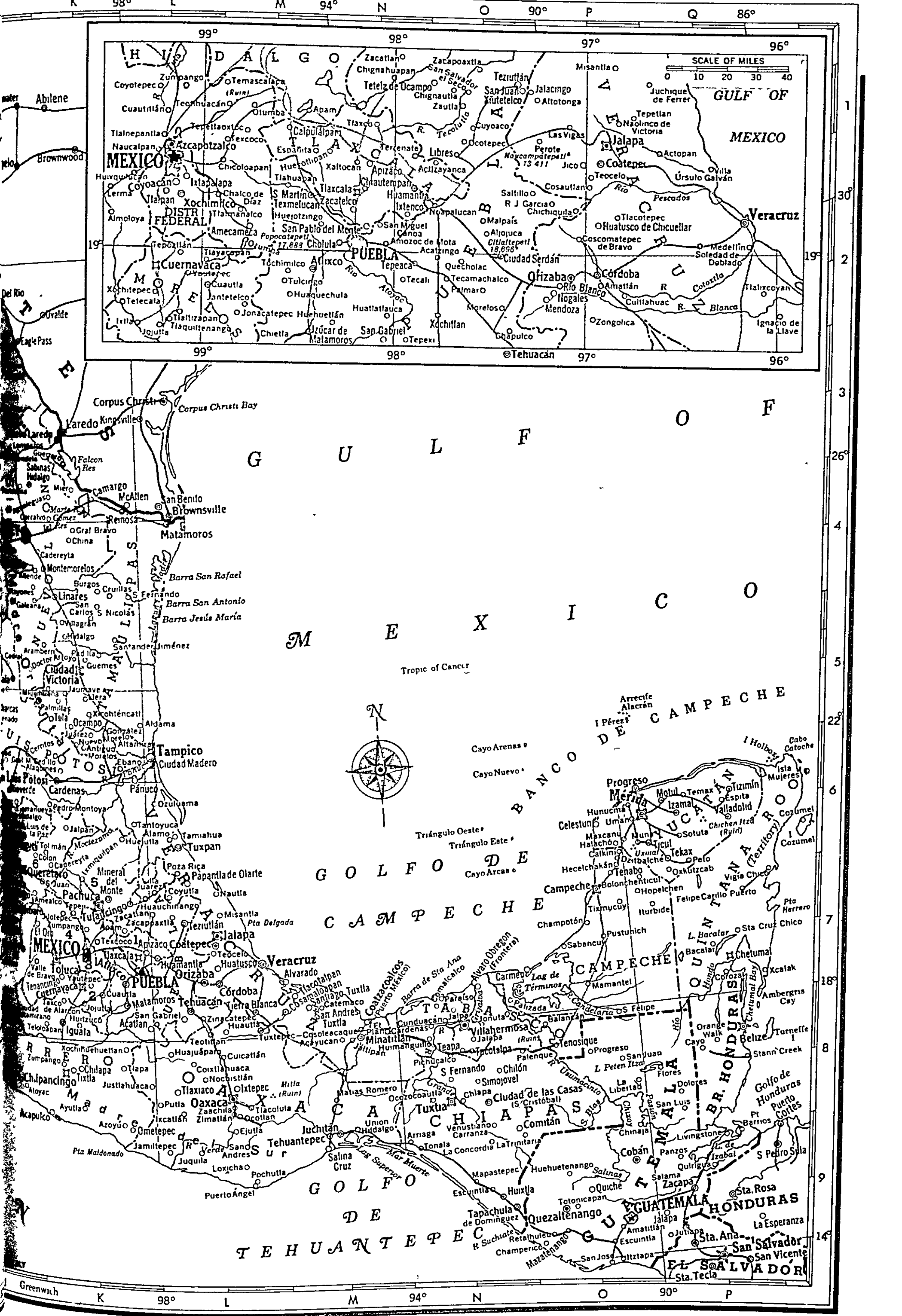
Longitude
West



SCALE OF MILES
0 10 20 30 40
GULF OF MEXICO
MEXICO
DISTR. FEDERAL
HIDALGO
TLAXCALA
PUEBLA
MORELOS
VERACRUZ
Azcapotzalco
Coyoacán
Xochimilco
Cuernavaca
Tlalnepantla
Texcoco
Chalco de Díaz
Amecameca
Tepoztlán
Teotihuacán
Otumba
Apam
Calpulalpan
Tlaxco
Zacatlán
Chignahuapan
Tetela de Ocampo
Zacapoaxtla
San Salvador el Seco
Teziutlán
San Juan Xiutetelco
Jalacingo
Altotonga
Misantla
Juchique de Ferrer
Tepetlán
Naolinco de Victoria
Jalapa
Coatepec
Actopan
Úrsulo Galván
Perote
Las Vigas
Libres
Huejotzingo
Cholula
Atlixco
Popocatepetl 17,888
Citlaltepetl 18,696
Naucampatepetl 13,411
Tlaxcala
Zacatelco
Apizaco
Huamantla
Ixtenco
Nopalucan
Amozoc de Mota
Acatzingo
Tepeaca
Tecali
Quecholac
Tecamachalco
Palmar
Ciudad Serdán
Chalchicomula
Orizaba
Río Blanco
Nogales
Mendoza
Córdoba
Amatlán
Cuitláhuac
Zongolica
Huatusco de Chicuellar
Coscomatepec de Bravo
Teocelo
Cosautlán
Tlacotepec
Veracruz
Medellín
Soledad de Doblado
Tlalixcoyan
Ignacio de la Llave
Izúcar de Matamoros
San Gabriel
Tepexi
Xochitlán
Chapulco
Tehuacán
Huatlatlauca
Huaquechula
Tochimilco
Tlaltizapan
Tlaquiltenango
Jojutla
Jonacatepec
Huehuetlán
Chietla
Tetecala
Xochitepec
Cuautla
Jantetelco
Yautepec
Tlayacapan
Abilene
Brownwood
Del Rio
Uvalde
Eagle Pass
Corpus Christi
Corpus Christi Bay
Laredo
Kingsville
Falcon Res.
Camargo
McAllen
San Benito
Brownsville
Reynosa
Matamoros
Barra San Rafael
Barra San Antonio
Barra Jesús María
Linares
Montemorelos
Cadereyta
China
Gral. Bravo
Burgos
Cruillas
S. Fernando
S. Nicolás
San Carlos
Villagrán
Hidalgo
Santander Jiménez
Ciudad Victoria
Guemes
Jaumave
Aldama
Xicohténcatl
Tula
Ocampo
González
Altamira
Tampico
Ciudad Madero
Ebano
Pánuco
Cárdenas
San Luis Potosí
Ozuluama
Tantoyuca
Tamiahua
Tuxpan
Poza Rica
Papantla de Olarte
Nautla
Misantla
Pta. Delgada
Teziutlán
Jalapa
Veracruz
Alvarado
Tlacotalpan
Cosamaloapan
Santiago Tuxtla
San Andrés Tuxtla
Catemaco
Coatzacoalcos (Puerto México)
Minatitlán
Acayucan
Tierra Blanca
Tehuacán
Córdoba
Orizaba
Puebla
Tlaxcala
Pachuca
Tulancingo
Querétaro
Mexico
Toluca
Cuernavaca
Iguala
Chilpancingo
Acapulco
Ometepec
Jamiltepec
Pta. Maldonado
Puerto Ángel
Pochutla
Oaxaca
Mitla (Ruin)
Tlaxiaco
Huajuápan
Juchitán
Tehuantepec
Salina Cruz
Lag. Superior
Mar Muerto
Tonalá
Arriaga
Tuxtla
Ciudad de las Casas (S. Cristóbal)
Comitán
Tapachula
Huixtla
Escuintla
Villahermosa
Frontera
Carmen
Lag. de Términos
Campeche
Champotón
Tenosique
Palenque
Mérida
Progreso
Motul
Izamal
Valladolid
Tizimín
Chichen Itzá (Ruin)
Uxmal (Ruin)
Ticul
Tekax
Peto
Celestún
Hunucmá
Maxcanú
Calkiní
Hecelchakán
Hopelchén
Isla Mujeres
Cozumel
Cabo Catoche
I. Holbox
Arrecife Alacrán
I. Pérez
Cayo Arenas
Cayo Nuevo
Triángulo Oeste
Triángulo Este
Cayo Arcas
BANCO DE CAMPECHE
GOLFO DE CAMPECHE
GULF OF MEXICO
Tropic of Cancer
N
YUCATÁN
CAMPECHE
TABASCO
CHIAPAS
OAXACA
QUINTANA ROO (Territory)
Felipe Carrillo Puerto
Vigía Chico
Sta. Cruz Chico
L. Bacalar
Bacalar
Chetumal
Xcalak
Corozal
Chetumal Bay
Orange Walk
Belize
Ambergris Cay
Turneffe I.
Stann Creek
Cayo
BR. HONDURAS
L. Petén Itzá
Flores
La Libertad
Dolores
San Luis
GUATEMALA
Cobán
Huehuetenango
Quezaltenango
Guatemala
Retalhuleu
Champerico
Mazatenango
San José
Jalapa
Zacapa
Puerto Barrios
Livingstone
Golfo de Honduras
Puerto Cortés
S. Pedro Sula
HONDURAS
Sta. Rosa
La Esperanza
Sta. Ana
San Salvador
San Vicente
Sta. Tecla
EL SALVADOR
GOLFO DE TEHUANTEPEC
Greenwich
K 98° L M 94° N O 90° P Q 86°
99° 98° 97° 96°
19° 30° 26° 22° 18° 14°
1 2 3 4 5 6 7 8 9

Melchor Ocampo	964	H 4
Mendoza	15,212	O 2
Meoqui	3,780	G 2
Mérida	144,793	P 6
Mexicali	64,658	B 1
México (state)	1,390,018	K 7
México (Mexico City) (capital)	2,233,914	L 1
Mexico (gulf)		N 4
Mezquital	651	G 5
Mezquital (river)		G 5
Michoacán (state)	1,415,257	J 7
Mier	1,866	K 3
Miguel Auza	4,753	H 4
Minatitlán	21,909	M 8
Mineral del Monte	12,552	K 6
Miquihuana	1,847	K 5
Misantla	2,847	P 1
Mita (point)		G 6
Mitla (ruins)		M 8
Mocorito	2,357	F 4
Moctezuma (*S. L. Potosí*)	1,765	J 5
Moctezuma (*Sonora*)	2,298	E 2
Moctezuma (river)		K 6
Monclova	19,054	J 3
Monserrate (island)		D 4
Montague (island)		B 1
Montemorelos	5,579	K 4
Monterrey	331,771	J 4
Morelia	63,248	J 7
Morelos (state)	272,952	K 7
Morelos (*Coahuila*)	2,377	J 2
Morelos (*Puebla*)	1,627	O 2
Moroleón	13,808	J 6
Motul	5,382	P 6
Muerto (sea)		N 9
Mujeres (island)		Q 6
Mulatos	609	E 2
Mulegé	846	C 3
Muna	3,798	P 6
Múzquiz	7,040	J 3
Nacozari	4,502	E 1
Nadadores	2,158	J 3
Naolinco de Victoria	3,453	P 1
Naucalpan	1,796	L 1
Naucampátepetl (mt.)		O 1
Nautla	1,418	L 6
Nava	2,101	J 2
Navojoa	17,348	E 3
Navolato	5,151	E 4
Nayarit (state)	291,088	G 6
Nayarit (mts.)		G 5
Nazas	1,668	G 4
Nazas (river)		G 4
Nieves	3,081	H 5
Noapalucan	2,187	O 1
Nochistlán (*Oaxaca*)	2,562	L 8
Nochistlán (*Zacatecas*)	4,151	H 6
Nogales (*Sonora*)	24,480	D 1
Nogales (*Veracruz*)	8,479	P 2
Nombre de Dios	1,875	G 5
Nonoava	617	F 3
Nuevo (cay)		O 6
Nuevo Laredo	57,669	J 3
Nuevo León (state)	735,692	K 4
Nuevo Morelos	290	K 5
Nuri	800	E 3
Oaxaca	46,156	L 8
Oaxaca (state)	1,414,516	L 8
Ocampo (*Chihuahua*)	947	E 2
Ocampo (*Coahuila*)	1,217	H 3
Ocampo (*Tamaulipas*)	2,006	K 5
Ocotepec	661	O 1
Ocotlán (*Jalisco*)	16,853	H 6
Ocotlán (*Oaxaca*)	4,270	L 8
Ocozocoautla		N 8
Ojinaga	2,227	G 2
Ojocaliente	4,566	H 5
Ometepec	4,643	K 8
Opodepe	654	D 2
Oputo	1,505	E 1
Orizaba	55,522	O 2
Orizaba (Citlaltepetl) (mt.)		O 2
Otumba	1,560	M 1
Oxkutzcab	5,050	P 7
Ozuluama	1,916	L 6
Ozumba	3,403	M 1
Pachuca	58,653	K 6
Padilla	1,115	K 5
Palenque		O 8
Palenque (ruins)		O 8
Palizada	1,348	O 7
Palmar	1,630	O 2
Palmillas	1,107	K 5
Palmito de la Virgen (isl.)		F 5
Palmito del Verde (isl.)		F 5
Pánuco (*Coahuila*)		J 3
Pánuco (*Veracruz*)	5,942	K 6
Pánuco (river)		K 5
Papantla de Olarte	11,361	L 6
Paraíso	1,753	N 7
Paricutín (vol.)		H 7
Parral	32,066	G 3
Parras	18,546	H 4
Pátzcuaro	10,331	J 7
Pátzcuaro (lake)		J 7
Paz, La (bay)		D 4
Pedro Montoya	2,907	K 6
Pénjamo	8,795	J 6
Peñón Blanco	2,649	H 4
Pérez (island)		P 5
Perote	4,072	P 1
Pescados (river)		Q 1
Petachalco (bay)		H 8
Peto	5,104	P 6
Pichucalco		N 8
Piedras Negras	27,579	J 2
Pinos	4,670	J 5
Pitiquito	1,472	D 1
Pochutla	2,456	L 9
Popocatepetl (mt.)		M 1
Poza Rica	14,726	L 6
Presa = reservoir (*Spanish*)		
Progreso	13,338	P 6
Puebla	206,840	N 2
Puebla (state)	1,619,546	L 7
Puerto Ángel	469	L 9
Puerto México (Coatzacoalcos)	19,501	M 7
Puerto Peñasco		C 1
Puerto Vallarta	3,150	G 6
Punta = point (*Spanish*)		
Purificación	1,344	G 7
Puruándiro	8,643	J 7
Pustunich	85	O 7
Putla	2,394	L 8
Quecholac	2,015	O 2
Querétaro	49,428	K 6
Querétaro (state)	285,896	J 6
Quintana Roo (terr.)	26,975	P 7
Rafael J. García	1,231	O 1
Ramos (river)		G 4
Ramos Arizpe	2,766	J 4
Rayón	1,241	D 2
Rayones	512	J 4
Reinosa	34,076	K 3
Revillagigedo (islands)		C 7
Rincón de Romos	4,460	H 5
Río Blanco	11,044	P 2
Río Grande	5,111	H 5
Río Grande (river)		N 8
Rioverde	10,107	J 6
Riva Palacio (San Andrés)	708	F 2
Roca Partida (island)		C 7
Rodeo	1,020	G 4
Rosamorada	1,151	G 5
Rosario (*Baja California*)	143	B 1
Rosario (*Durango*)		G 3
Rosario (*Sinaloa*)	8,323	G 5
Rosario (*Sonora*)	963	E 3
Sabancuy	882	O 7
Sabinas	11,256	J 3
Sabinas (river)		J 3
Sabinas Hidalgo	6,912	K 3
Sahuaripa	3,195	E 2
Sahuayo	12,514	H 6
Sain Alto	2,372	H 5
Salada (Macuala) (lag.)		A 1
Salamanca	19,589	J 6
Salina Cruz	4,614	M 9
Salinas	4,255	J 5
Saltillo (*Coahuila*)	69,874	J 4
Saltillo (*Puebla*)	707	O 1
San Andrés Tuxtla	15,116	M 7
San Andrés (Riva Palacio)	708	F 2
San Andrés (*Oaxaca*)	3,968	L 8
San Antonio	971	D 5
San Antonio (reef)		L 4
San Benedicto (island)		D 7
San Benito (island)		B 2
San Blas	752	G 6
San Blas (river)		O 8
San Buenaventura	3,541	J 3
San Carlos (*Coahuila*)	688	J 2
San Carlos (M. Benavides)	779	G 2
San Carlos (*Tamaulipas*)	1,118	K 4
San Carlos (Villa Úrsulo Galván)	1,349	Q 1
San Cristóbal (Ciudad de las Casas)	17,449	O 8
San Dimas	1,948	F 4
San Felipe (*Baja Calif.*)	427	B 1
San Felipe (*Campeche*)		O 8
San Fernando (*B. Cal.*)		B 2
San Fernando (*Chiapas*)		N 8
San Fernando (*Tamaulipas*)	1,471	L 4
San Francisco	18,193	H 6
San Francisco del Oro	11,458	F 3
San Gabriel Chilac	6,091	N 2
San Ignacio	1,914	F 5
San Javier	598	D 2
San Jorge (bay)		C 1
San José (island)		D 4
San José del Cabo	2,553	D 5
San Juan (*Coahuila*)	785	J 2
San Juan (*Jalisco*)	5,792	H 6
San Juan (*Querétaro*)	6,694	K 6
San Juan de Guadalupe	2,641	H 4
San Juan del Río	1,956	G 4
San Juan Xiutetelco	1,877	O 1
San Lázaro (cape)		C 4
San Lucas (cape)		E 5
San Luis de la Paz	4,821	J 6
San Luis del Cordero	1,352	H 4
San Luis Potosí	126,596	J 6
San Luis Potosí (state)	855,994	J 5
San Marcos (island)		D 3
San Martín Texmelucan	11,333	M 1
San Miguel (*Guanajuato*)	11,615	J 6
San Miguel Canoa	4,652	N 1
San Nicolás	298	K 4
San Pablo del Monte	7,652	M 1
San Pedro	19,263	H 4
San Pedro del Gallo	1,203	G 4
San Quintín		B 1
San Rafael (reef)		L 4
San Salvador el Seco	4,365	O 1
San Telmo	76	B 1
San Vicente	214	A 1
Sánchez		E 3
Santa Ana	3,057	D 1
Santa Ana (reef)		N 7
Santa Bárbara	14,805	F 3
Santa Catalina (island)		D 4
Santa Clara	1,623	H 4
Santa Cruz	757	D 1
Santa Cruz (island)		D 4
Santa Cruz Chico		Q 7
Santa Eugenia (point)		B 3
Santa Inés (bay)		D 3
Santa Margarita (island)		C 4
Santa María	1,445	G 6
Santa María (lake)		F 1
Santa María (river)		F 1
Santa Rosalía	5,451	C 3
Santander Jiménez	1,639	L 4
Santiago (*B. Cal.*)	746	E 5
Santiago (*Nayarit*)	7,322	G 6
Santiago Tuxtla	5,392	M 7
Santiago Papasquiaro	3,204	F 4
Santiaguillo (lake)		G 4
Saucillo	3,826	G 2
Sayula	10,096	H 7
Sebastián Vizcaíno (bay)		B 2
Sierra Mojada	916	H 3
Sierra = mountains (*Span.*)		
Silao	18,463	J 6
Simojovel		N 8
Sinaloa	1,290	F 4
Sinaloa (state)	622,002	F 4
Socorro (island)		D 7
Soledad	2,227	J 5
Soledad de Doblado	3,817	Q 2
Sombrerete	5,628	H 5
Sonora (state)	507,853	D 2
Sonora (river)		D 2
Sotuta	2,923	P 6
Soyopa	590	E 2
Suaquí	1,144	E 2
Suchiate (river)		N 9
Superior (lagoon)		M 9
Tabasco (state)	362,195	N 7
Tacambaro	4,173	J 7
Tacotalpa	628	N 8
Talpa	2,722	G 6
Tamaulipas (state)	717,281	K 4
Tamazula	523	F 4
Tamiahua	2,319	L 6
Tampico	94,221	L 5
Tantoyuca	3,916	L 6
Tapachula de Domínguez	30,064	N 9
Taxco de Alarcón	10,076	K 7
Teacapan (inlet)		F 5
Teapa	2,199	N 8
Tecali	1,409	N 2
Tecamachalco	4,014	O 2
Tecolutla (river)		O 1
Tecomán	3,295	H 7
Tecpan de Galeana	3,232	J 8
Tecuala	6,456	G 5
Tehuacán	23,213	L 7
Tehuantepec	10,087	M 8
Tehuantepec (gulf)		M 9
Tekax	6,061	P 6
Teloloapan	5,140	J 7
Temascalapa	1,348	M 1
Temax	3,312	P 6
Temósachic	1,504	F 2
Tenabo	1,990	P 6
Tenancingo	6,644	K 7
Tenosique	3,545	O 8
Teocaltiche	7,909	H 6
Teocelo	3,058	P 1
Teotihuacán	1,353	L 1
Teotihuacán (ruins)		M 1
Teotitlán	2,192	L 8
Tepatitlán	15,073	H 6
Tepeaca	3,963	N 2
Tepehuanes	1,230	G 4
Tepeji	5,815	K 6
Tepetlán	696	Q 1
Tepetlaoxtoc	1,763	L 1
Tepexi	1,683	N 2
Tepic	24,600	G 6
Tepoztlán	3,230	L 1
Términos (lagoon)		O 7
Terrenate	947	N 1
Tetecala	1,892	L 2
Tetela de Ocampo	707	N 1
Texcoco	5,437	M 1
Teziutlán	8,386	O 1
Tiburón (island)		C 2
Ticul	10,235	P 6
Tierra Blanca	12,007	L 7
Tierranueva	1,420	J 6
Tijuana	60,740	A 1
Tixmucuy	299	O 7
Tixtla	6,130	K 8
Tizimín	10,651	Q 6
Tlacolula	5,297	L 8
Tlacotalpan	4,939	M 7
Tlacotepec	1,593	P 1
Tlahualilo	2,949	H 3
Tlahuapan	1,507	M 1
Tlalixcoyan	1,058	Q 2
Tlalmanalco	2,479	L 1
Tlalnepantla	10,330	L 1
Tlalpan	18,160	L 1
Tlaltenango	4,627	H 6
Tlaltizapán	1,966	L 2
Tlapa	2,976	K 8
Tlaquiltenango	2,518	L 2
Tlaxcala	3,261	M 1
Tlaxcala (state)	284,261	K 7
Tlaxco	1,119	N 1
Tlaxiaco	6,604	L 8
Tlayacapan	1,743	L 1
Tochimilco	2,192	M 2
Todos Santos	1,831	D 5
Tolimán	2,105	K 6
Toluca	52,789	K 7
Tomatlán	741	G 6
Tonalá	10,500	N 8
Topia	457	F 4
Topolobampo	598	E 4
Toronto (lake)		G 3
Torreón	128,548	H 4
Tres Marías (islands)		F 6
Triángulo Este (island)		N 6
Triángulo Oeste (island)		N 6
Tula	4,558	K 5
Tula (river)		L 1
Tulancingo	18,543	K 7
Tulcingo	1,881	M 2
Tuxpan (*Jalisco*)	6,763	H 7
Tuxpan (*Nayarit*)	11,608	G 6
Tuxpan (*Veracruz*)	15,707	L 6
Tuxtepec	4,912	L 7
Tuxtla Gutiérrez	28,262	N 8
Umán	3,679	P 6
Unión Hidalgo	4,929	M 8
Ures	2,981	D 2
Urique (river)		F 3
Uruáchic	395	E 3
Uruapan	31,410	H 7
Usumacinta (river)		O 8
Uxmal (ruins)		P 6
Valladolid	6,402	P 6
Valle de Allende	2,400	G 3
Valle de Bravo	3,956	J 7
Valle de Santiago	15,683	J 6
Vanegas	1,633	J 5
Venado	2,011	J 2
Venustiano Carranza		N 5
Veracruz	101,469	Q 1
Veracruz (state)	2,030,462	L 7
Verde (river)		F 3
Verde (river)		L 8
Viesca	3,370	H 4
Vigía Chico		Q 2
Villa Acuña	11,355	J 7
Villa Coronado	815	G 3
Villa de Álvarez	2,044	G 7
Villa de Cos	1,119	H 5
Villa de Seris	1,150	D 2
Villa Frontera	6,035	J 3
Villa García	1,922	J 5
Villa Juárez	4,797	L 6
Villa Unión (*Durango*)	2,936	F 5
Villa Unión (*Sinaloa*)	4,002	F 5
Villa Úrsulo Galván (San Carlos)	1,349	Q 1
Villagrán	1,128	K 4
Villahermosa	33,588	N 8
Villaldama	2,648	J 3
Villanueva	4,241	H 5
Xaltocan	1,373	N 1
Xcalak	425	Q 7
Xicohténcatl	991	K 5
Xochihuehuetlán	2,988	K 8
Xochimilco	20,711	L 1
Xochitepec	1,532	L 2
Xochitlán	1,720	N 2
Yaqui (river)		E 2
Yautepec	4,538	L 2
Yucatán (state)	518,798	P 6
Zaachila	4,513	L 8
Zacapoaxtla	2,163	O 1
Zacatecas	23,576	H 5
Zacatecas (state)	661,846	H 5
Zacatelco	7,029	M 1
Zacatlán	3,804	N 1
Zacoalco	6,227	H 6
Zamora	23,440	H 7
Zaragoza	3,510	J 2
Zautla	858	O 1
Zimatlán	3,970	L 8
Zinacatepec	4,131	L 7
Zitácuaro	19,940	J 7
Zongolica	1,296	P 2
Zumpango (*Guerrero*)	3,266	J 8
Zumpango (*México*)	5,583	L 1

church bells—is the quick pat-pat of the women's hands as they shape the moist meal into a cake for frying. Boiled black beans (*frijoles*) are second only to corn in importance. Because water is so scarce most of the people drink *pulque*, made from the fermented sap of the maguey or agave (*see* Agave).

Clothing of the Country People

The master of the household wears woven leather sandals (*huaraches*), though his wife and children are usually barefoot. His suit looks like pajamas. It is made of a coarse white cotton cloth called *manta*, and has a baggy seat and loose legs, gathered in tightly at the ankles. A big sombrero and a woolen blanket, or *serape*, complete his costume. The serape serves as an overcoat and is worn folded over one shoulder when not in use. All his personality is expressed in the tilt of his sombrero and the fling of his serape.

Every woman wears the *rebozo*, which is a shawl, usually of dark blue cotton. Like the man's serape, it is her only protection against cold, wind, and rain. Worn folded on the head it serves as a sunshade. Skillfully twisted over her shoulder and around her waist it will support a baby or a tired child, leaving her arms free for the perpetual work of field and household. In Yucatan, the lowlands of Tehuantepec, and the remote mountain valleys of Chiapas, the beautiful tribal costumes of olden times are still worn.

Gay, Carefree, and Independent

The "wantlessness" of the average Mexican is the despair of foreign salesmen. He raises only enough food for his family. With his own hands he makes most of his simple household necessities. A skillful craftsman, an instinctive artist, he works for love of the task and only incidentally for money. In the weekly market of his own or neighboring villages he exchanges whatever surplus he may have for salt, gunpowder, a bolt of cotton cloth. If anyone meeting him on the road should attempt to purchase his entire stock, he would refuse to sell. For the market is a social event, and with nothing to barter he would miss all the fun.

Frequent fiestas provide color and gaiety. They center about the saints' days and other celebrations of the Roman Catholic church, but many of the dances and ceremonies are survivals of ancient Indian rituals. The beauty of these fiestas with their elaborate costumes, their flowers, fireworks, and the ceremonial use of candle and fire light can never be forgotten.

The People of the Cities

Most of the city dwellers are almost as poor as the farmers. The laborers live in one or two-room tenements. They wear shoes instead of huaraches, blue denim overalls instead of white trousers. They sleep on beds, eat a little better, see an occasional movie, even own a radio. But not more than 5 per cent of the Mexican people enjoy the comforts that middle-class Americans take for granted.

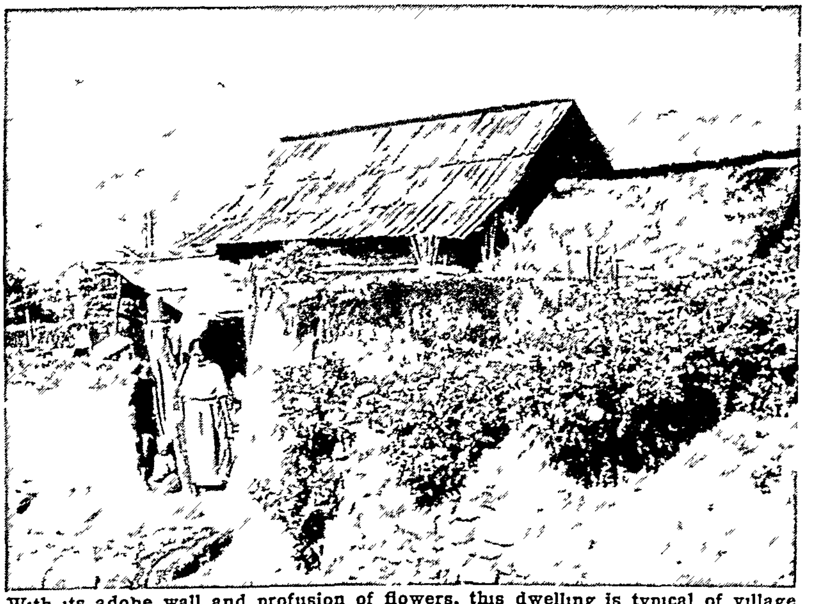
The homes of the well-to-do—the professional and businessmen, the hacienda owners, and the government officials—are often built in the Spanish colonial style of architecture. Many beautiful homes of the Spanish period, 200 to 300 years old, still remain. The life of the household faces inward on the patio, or courtyard, with its gardens, fountains, and caged birds. A large house may have several such patios. Modern architecture is found in the new subdivisions of the large cities.

The Children of Mexico

The children of Mexico are having a share in the life and future of their country beyond anything their fathers knew. They are eager, curious, friendly, and quick to grasp anything new.

In the cities among the professional classes and the merchants, or on the large plantations, the young people are not unlike those of the United States. Most of them go to private schools, dress as American children do, play the same games. Toys and dolls come from Europe and Japan, as well as from Mexico. Books for Mexican children have always been few; and these have been largely translations from the classics of other countries: French and German fairy tales, Robinson Crusoe, Pinocchio, and stories about the saints. Some Mayan folk-tales and the stories of Don Coyote are among the few of native origin. But they have the Walt Disney books that have followed the cartoons. The boys of well-to-do parents nearly all own at some time a *charro* suit, consisting of tight trousers with ornamental buttons down the legs, a short jacket, flowing tie, and elaborate sombrero. They wear it as our boys wear cowboy suits, playing the

MEXICAN HOME—DUSTY AND SUN-BAKED



With its adobe wall and profusion of flowers, this dwelling is typical of village homes throughout the plateau. In the distance lies the snow-crowned volcano Ixtaccihuatl, beloved "White Woman" Mountain.

SOME GAY AND PICTURESQUE COSTUMES

At the left is a young farmer in everyday dress of white manta cloth, serape, and sombrero. His wife, in holiday costume, is wearin the rebozo over her head. At the right is a well-to-do horseman in the *charro* costume of the old Spanish ranchmen.

same games, riding real or make-believe horses, and learning to do tricks with a rope.

Primary school education has come to all but the most inaccessible parts of Mexico. High schools are still to be found only in the larger cities. Children are taught such practical things as hygiene, gardening, cooking, and the traditional handicrafts of their country. At noon in many public squares loudspeakers broadcast the news of the day. Here the boys and girls gather to listen, between the hours of school and the hours of work.

In the cities many of the boys go to school for half a day; for the other half, they are apprenticed to a master of some *fábrica*. Here they are taught the fine crafts of Mexico: glass blowing, tin and silver work, weaving, pottery making. If the father is a tinsmith, the boy becomes one and carries on with pride the designs and the skill that have been passed down in his family. Sons wear the same kind of clothes as their fathers.

The little girls dress as their mothers do, in faded print dresses and blue rebozos. They help in the cooking, washing, and minding the younger children. The boys also help care for the babies and toddlers.

Many Mexican children have to earn money to help feed the large families. Tourists are an important source of income. The children offer their services as guides and sell flowers, post cards fruits, and handmade novelties produced by their parents, such as baskets, straw dolls, clay figures, pottery, and textiles.

CHILDREN OF TAXCO

Wherever you find them, rich or poor, in country or city, Mexican children are usually bright, happy, and polite.

The children of the poor have few toys. Rarely does one see even a doll, and then it is woven of raffia. But the children invent games and play them with shouts of laughter: games with bottlecaps, pebbles, and improvised tops. The boys make balls of newspaper wound with twine and play the American game of "futbol." In groups they play chasing games, circle games, and hide-and-seek.

The Mexican children are the happiest on days of fiesta, which they celebrate with their parents. Much is made over the food, the clean garments for the family, the "animation" everywhere. Carnival, which precedes Lent, is the merriest of all fiestas. All night the bands play in the public squares. The merry-go-rounds are set up, and the proprietors grind the cranks that turn the wooden horses and play the music. Often there are jugglers. On every corner braziers are cooking tamales, enchiladas, and tortillas; and the good smells fill the town.

The Day of San Francisco is still observed in some parts of Mexico with the ancient custom of blessing all the domestic animals. Boys and girls bring in the small burros, the

oxen, the horses, the goats, and the sheep to be blessed that they may keep well and multiply.

Farmers Without Land

Mexico is a nation of farmers on land that nature never intended to be farmed. Seventy per cent of the people are trying to make a living on only 7 per cent of the land. The rest is mountain, desert, or forest. At least half of this small amount of arable land lies fallow each year. Harvests on the other half are small because of primitive methods of cultivation and lack of fertilizers. The result is that Mexico does not produce enough food to feed its people. President Alemán in 1947 announced a six-year irrigation plan to bring water to some 3,600,000 additional acres of land. The cost of new dams is estimated at about 200 million dollars.

The staple food and principal crop for unknown centuries has been corn. Three times as much corn is planted as wheat, rice, and beans combined. The methods of cultivation have changed very little since Aztec times, with the result that the yield averages only 8.7 bushels an acre, as compared with 23 bushels an acre produced in the United States. Corn is one of the most soil-exhausting crops. A corn field (*milpa*) can be planted only two or three seasons, then it must lie fallow for several years, for the average farmer cannot afford to buy fertilizers. Many economists believe that Mexico should stop growing this cereal altogether and put the land to more profitable use.

Beans (*frijoles*) are second in acreage and in importance as a food staple. They are grown throughout the country. Cotton is cultivated under irrigation in Lower California and on the Northern Plateau. About half of it comes from the communal farms of the lake district around Torreón. Mexican cotton mills use most of the product. Wheat suffers from uncertain rainfall and lack of irrigation. The most productive areas are the Central Plateau and the north Pacific coast. Sugar cane was one of the first crops developed by the Spanish. Large areas suitable for cane are yet undeveloped, especially on the hot Gulf coast.

Tobacco of fine quality grows on the coasts and in the southern state of Oaxaca. Practically all of it is used in the 200 or more cigar and cigarette factories. A fine quality of coffee comes from the seaward slopes of Chiapas and Vera Cruz at altitudes of 2,500 to 4,000 feet. About a third of it is exported to the United States. The irrigated river valleys of the west coast along the Gulf of California are producing high-grade winter vegetables for export to the United States. Tomatoes were grown by the Aztecs, who gave us the word (in the Nahuatl language, *tomatl*). Both temperate- and tropical-zone fruits are cultivated commercially. Vanilla, castor beans, and

SKILLFUL AND ARTISTIC CRAFTSMEN

In most of the Indian villages the people specialize in a particular craft. Some make rush-bottomed chairs (upper right). Others turn out pottery of distinctive design (lower right). Notice the toy animals of modeled clay at the feet of the little boy. The old woman (lower left) is preparing fiber from the maguey plant. It will be woven into rope or made into baskets.

cacao are among the many tropical plants produced for export. Guayule, a source of rubber, grows wild on the Northern Plateau (*see* Guayule). Old rubber plantations are being rehabilitated in the southeastern states, and production is growing rapidly.

The grasslands of the Northern Plateau have been devoted to cattle raising since colonial times. The breeds are inferior, due to poor pasturage, scanty water supply, and neglect. Tallow and hides are the chief commercial products.

From Yucatán comes half of the world's supply of henequen, a cordage fiber (*see* Sisal). This is the most valuable agricultural export. Another useful fiber plant extensively grown on the Central Plateau is maguey (*see* Agave).

Magnificent forests occupy about one fifth of the total land area. Chicle, the basis for chewing gum, is the most valuable forest product. Most of the world's supply comes from the Yucatán peninsula and adjoining areas in Guatemala and British Honduras. Valuable cabinet woods and dyewoods are exported, but large areas are undeveloped because of the difficulties and expense of transportation.

Land and the Hacienda System

The form of land holding is highly wasteful. In 1930 nearly 90 per cent of the agricultural area was held in haciendas. By definition a hacienda comprises at least 1,000 hectares (2,471 acres). The average size is 7,000 to 8,000 acres, but some exceed 50,000 acres. Although many of these great estates have been broken up since the last census and their lands distributed to the people, they are still the prevailing form of land tenure. The owner, the *hacendado,* is more interested in politics than in agriculture. He lives in the capital city or abroad and visits the manor house at rare intervals.

Scattered over the immense estate are the villages of the peons—the share croppers and hired laborers. Once virtual slaves of the hacendado, they are now given some protection by law, which requires that they be paid a minimum wage and be given decent living quarters, schools, and a tract for subsistence farming and grazing of domestic animals. Peonage, or debt bondage, is still common in actual practice, but many hacienda workers are now organized in their own trade unions and can demand that the law be observed.

A new form of land ownership is the *ejido* (*ā-hē'thō*), or co-operative farm. Managed in common by a village or group of farmers, it is financed and supervised by the federal government.

History of the Co-operative Farms

The revolution which broke out in Mexico in 1910 grew out of land abuses extending back more than 300 years. When the Spaniards conquered Mexico, they distributed its best lands among a few families in huge grants known as *encomiendas,* or "trusts." The Indians went with the land, becoming virtual slaves.

At first the Spaniards permitted the Indians to keep their communal lands owned by the village or clan. They were called *ejidos,* meaning "way out," because they lay on the outskirts of the villages. The Indians supported themselves on the ejidos in whatever time they could spare from labor on the master's estate. In time most of the ejidos were swallowed up by the haciendas.

During the long dictatorship of Porfirio Díaz, 1877–1910, the last of the ejidos were given to political favorites and foreign speculators. By 1910 less than 4 per cent of the farmers owned any land, while the estate of one family on the Northern Plateau equaled the combined area of Denmark, Switzerland, and the Netherlands. As day laborers on their own ancestral lands, the Indians were paid the equivalent of five cents a day. Many ran away from the haciendas to become starving vagrants, willing to follow any leader who promised them relief from poverty. Thus the stage was set for the revolution.

"Land and liberty" was its battle cry. Article 27 of the Constitution of 1917 empowered the government to break up the large estates and restore the ejidos to the people. For 20 years the program proceeded slowly. Then, under the administration of President Lázaro Cárdenas, 1934–39, 45½ million acres were distributed. By 1950 about 75½ million had been distributed.

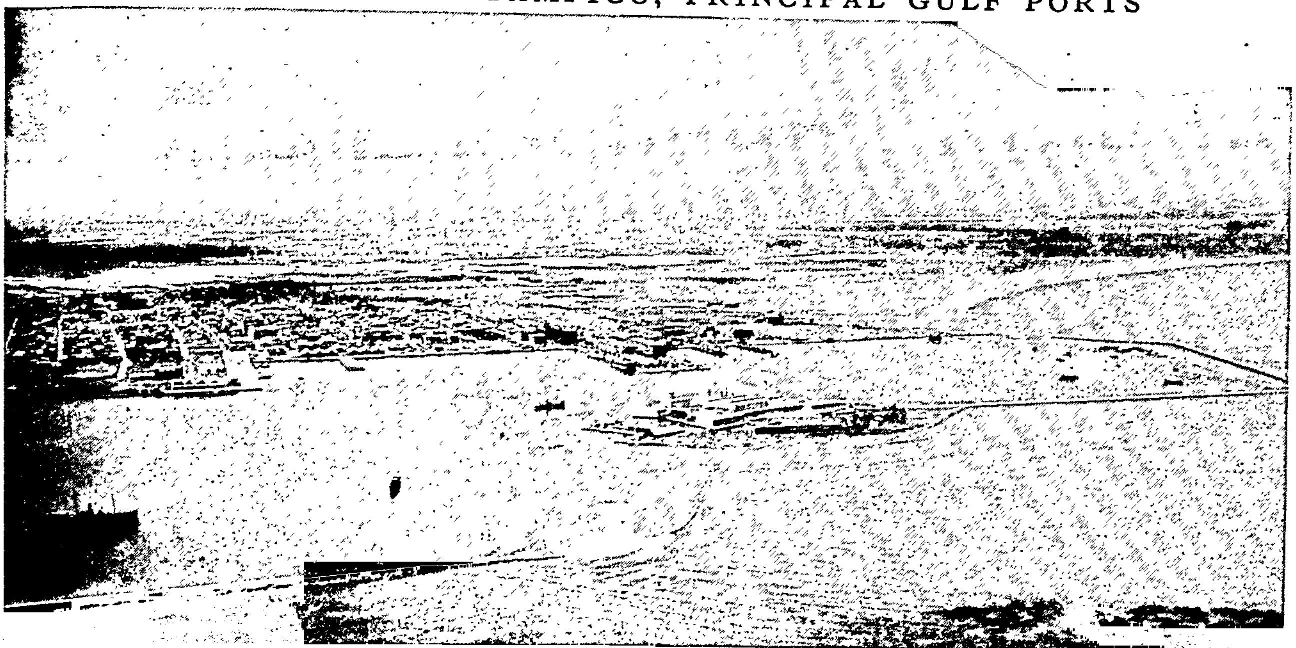
Title to an ejido was held by the state on behalf of a village or a group of farmers co-operatively organized. It could not be sold, leased, or mortgaged. Government surveyors marked out the land, and a village committee then assigned lots to heads of families. Each lot comprised at least four hectares (about ten acres) of irrigated or fertile land, or a larger amount of less productive land. The National Bank for Ejidal Credit financed the farms, granting loans for seed, animals, and machinery. It built irrigation systems and marketed the commercial crops. Loans were made only to co-operative groups, not to individuals. When Avila Camacho became president in 1940 he decreed that individual titles of ownership be given to all farmers. The lands may, however, continue to be worked co-operatively. By 1952 about one fourth of the Mexicans lived on ejidos of about ten acres which they worked as individual cultivators. A smaller percentage work on big collective farms. The largest collectives are in the Laguna (lake) district around Torreón, where half a million acres were taken from five families and given to some 40,000 farm families. The sugar-cane district of Morelos, the wheat lands of Sonora, and the henequen plantations of Yucatán were also made into collective farms.

Enormous Mineral Wealth

In the mountains and beneath the deserts that are so unfriendly to agriculture lies untold mineral wealth. Gold and silver drew the Spaniards like a magnet across the seas. Cortez told one Aztec lord that the Spaniards were "troubled with a disease of the heart for which gold is a specific remedy."

On the slave labor of the Indian the Spaniards grew fabulously rich. The Count de Regla, on the occasion of his son's christening, paved the street from his house to the cathedral with ingots of silver.

VERA CRUZ AND TAMPICO, PRINCIPAL GULF PORTS



Vera Cruz (upper) on the hot gulf coastal plain is Mexico's most important port. In the foreground is Fort San Juan de Ulúa. North of Vera Cruz is Tampico (lower), oil-refining center and shipping point. The broad stretch of water is the Pánuco River.

The splendid palaces of the silver kings made Mexico City one of the most beautiful capitals in the world. In gratitude for their easy riches they built magnificent churches which are literally encrusted with precious metals.

Minerals and oil are still the country's greatest source of wealth and account for almost three-fourths of the total value of exports, although they employ only 2 per cent of the workers. Silver is first in value. Mexico supplies 30 to 40 per cent of the world's annual production, 10 per cent of it from a single mine which has been worked since Montezuma's time. In the production of lead Mexico is second to the United States, and it is among the leaders in gold, zinc, and copper. It is the United States chief source of graphite, antimony, and mercury—three of the strategic war materials. Reserves of tungsten, arsenic, and cadmium are huge. Near the Texas border, around Sabinas, are enormous deposits of coal which have scarcely been touched. The Cerro de Mercado, near Durango, is a fabulous hill of iron estimated to contain 460 million tons of high-grade ore.

Petroleum reserves cover about 150 million acres along the gulf coast extending 100 miles inland. Only 15,000 acres are developed. The oil goes by pipe line and by barge on the Pánuco River to Tampico.

From a peak of 194 million barrels in 1921, when Mexico ranked second to the United States, production has declined to about 40 million barrels, giving the country seventh place. Declining yield of old wells and political disturbances which have prevented exploratory work in new areas are responsible.

Oil and Expropriation

A dramatic episode during the régime of President Cárdenas was the nationalization of the oil wells.

At least 95 per cent of the oil properties were owned and operated by foreign interests, chiefly the United States and Great Britain, who obtained possession of them during the régime of Díaz. The framers of the 1917 Constitution maintained that Díaz had no right to sign away his country's resources, and in Article 27 they declared that direct ownership of all mineral deposits and subsoil resources is vested in the nation. Foreigners may acquire ownership in lands, water, or mines, or obtain concessions to develop them, only if they agree to abide by Mexican laws and not to invoke the protection of their own governments.

In 1937 the oil workers went on a strike, demanding higher wages and a share in the management of the properties. The dispute was submitted to the Labor Board, which upheld the workers. The oil companies requested an injunction, but the supreme court denied the injunction and sustained the findings of the Labor Board. When the companies still refused to comply with the award of the court, President Cárdenas expropriated their properties on March 18, 1938.

The British government was not satisfied with the indemnity offered and broke off diplomatic relations. The United States recognized Mexico's "right to expropriate properties within its jurisdiction" but insisted on compensation. In April 1942 the two governments reached an agreement on terms of settlement. In 1949, American oilmen were permitted to re-enter the country to explore and develop new areas. They finance their own activities in return for a percentage of the profits. Title to the oil lands remains with Mexico.

Mining and smelting are still 98 per cent controlled by foreigners. The United States has an investment of some 200 million dollars in Mexico's "number one" industry. The metals are sold abroad where the profits remain. Mexico retains only the taxes paid to the state and the wages paid to the miners.

Effective Transportation Handicapped

About 15,000 miles of main-line railroad serve the nation and link it to the United States. In 1943 the government took control of the network, including foreign-owned lines. Railways suffer from old, inadequate equipment and the lack of branch lines to connect production zones with the leading markets. The Export-Import Bank in the United States has advanced funds for new lines and equipment. The old line across the Isthmus of Tehuantepec has been modernized. It connects Coatzacoalcos (Puerto México) on the Gulf of Mexico with Salina Cruz on the Pacific. Both terminal ports were improved. In May 1950, a new railroad joined Yucatan with the rest of the Mexican mainland for the first time. The line goes from Coatzacoalcos to Tenosique, where it joins an older line to Campeche and Mérida.

ACAPULCO BAY ON THE PACIFIC COAST

The beautiful harbor of Acapulco lies at the foot of sheer mountains. The village is a popular tourist resort with many fine modern hotels.

The Pan American Highway from Laredo, Tex., to Mexico City, a distance of 770 miles, has brought a profitable stream of tourists into the country. The road is completed to Ocotal on the Guatemala border, where it will connect with Guatemala's section of the road. The Central Highway extends from Juarez, on the Texas border, to Mexico City. The leading cities are now connected with motor highways, and bus transportation is highly efficient. Intervillage roads are still badly needed. Air lines are well developed.

Growth of Manufacturing

The possibilities for industrial development are very great. Raw materials are abundant and varied. On the borders of the plateau are immense power resources in the falling streams. The two greatest handicaps are lack of money to invest in large-scale enterprises and the low purchasing power of most of the Mexican people. During the second World War Mexican industry saw a tremendous growth. With the aid of foreign capital, largely from the United States, the country built new steel mills, petroleum refineries, silk and rayon mills, hydroelectric power plants, airplane and tire factories, and many others.

Mexico City is the leading manufacturing center, producing more than a fourth of the total value (see Mexico City). Food products are first in value and employ about a third of the industrial workers of the country. Cotton textiles occupy second place, with 15 per cent of the workers. The towns of Puebla and Orizaba are the centers of textile manufacture, utilizing water power from snow-fed streams racing down the edge of the plateau.

Monterrey is the "Pittsburgh" of Mexico, the center of its iron and steel industry. Raw materials are close at hand—limestone in the immediate vicinity, iron from Durango to the southwest, and coal from the near-by Sabinas field. Next to Mexico City as a manufacturing and railroad center, Monterrey also has lead smelters and refineries, a large brewery, flour and cotton mills, tile, glass, soap, and tobacco factories, and railroad repair shops.

Vera Cruz is the center of tobacco manufacturing. The weaving of table linen is a new and prosperous industry in Oaxaca. Huaraches, or native-style woven sandals, are exported, chiefly from Oaxaca and Cuernavaca. Every village has its handicrafts.

Industrial Labor in Mexico

The lot of the industrial worker under Díaz was as intolerable as that of the peon. Those who agitated for better conditions were starved into submission. Article 123 of the 1917 Constitution is a "bill of rights" for labor. The Constitution in itself does not have the

force of law. Its provisions are enforced by the federal labor law, which was passed in 1931. This is one of the most elaborate and radical labor codes in existence.

Wages, hours, the protection of women and children, safety and hygiene, compensation for illness and accident are all prescribed in greatest detail. Trade-union membership is obligatory. Government boards of conciliation and arbitration settle all disputes, including dismissal of an employee. Discharged workers must be paid three months' salary. The Social Security Act of 1943 provides further protection by establishing compulsory insurance against unemployment, accident, illness, and old-age dependency. The Institute of Social Security administers the act.

The first union to appear under the protection of the new constitution was the Regional Confederation of Mexican Labor (CROM). Its leader, Luis N. Morones, undertook the task of organizing an illiterate, inexperienced, undisciplined people who had never before attempted co-operative action. One of his associates, young intellectual, Vicente Lombardo Toledano, broke with him to form in 1936 the Confederation of Mexican Workers (CTM). This is now the most powerful union, with a membership of a million industrial and agricultural laborers. Toledano organized the Latin American Workeis' Confederation, an international union with headquarters in Mexico City.

AN OUTDOOR RURAL SCHOOL

In this simple outdoor school, a bench, a blackboard, and a piece of chalk are the chief equipment. These Tarascan Indian children are eager to learn how to read and write. Many adults are just beginning to learn these fundamentals.

Education—The Rural-School Movement

The difficulties of providing education for the masses of the Mexican people aie overwhelming. The poverty of the country limits expenditures for equipment and teachers' salaries. Attendance is very low, for many of the children must work to supplement the family's income.

In spite of obstacles, remarkable progress has been made. Before the revolution there was no rural-school system. Compulsory education was unknown. Illiteracy ran as high as 90 per cent. During the first ten years of bloodshed nothing could be done about schools, although Article 3 of the 1917 Constitution provided for free secular education. The start was made under President Obregón in 1922 when the federal department of education was formed with José Vasconcelos as secretary. He turned the campaign against illiteracy into a crusade. Thousands of volunteer teachers offered their services. Their school was a corner of a patio, their equipment a plaster wall and a bit of chalk. Otheis took up the work Vasconcelos had begun. Starting with nothing in 1922, by 1938 they had established about 20,000 rural schools.

The movement received fresh inspiration under President Avila Camacho. In 1945 he launched a campaign to teach 10 million illiterates. Its slogan was "Each teach one." Every adult who could read and write was urged to teach one who could not. Funds were raised to hire teachers and establish night schools. More than 60,000 night schools were opened in ten months, with an enrollment of 1,750,000. In the first six months, 278,000 adults passed their examinations. Indians are taught in their native dialects as well as in Spanish.

President Alemán carried on the work launched by his predecessors. The 1952 national budget provided more money for education than for any other government program except public works. With increased funds for school buildings and teachers, Mexico City for the first time in its history did not have to turn away a single pupil.

"Socialized" courses of study as taught in the new rural schools are designed to improve living conditions in the entire community. In the school gardens better methods of agriculture are demonstrated and new vegetables raised to improve the community's diet Local crafts are ievived as a supplementary source of family income. Hygiene and sanitation are not only studied in theory but put into practice. The

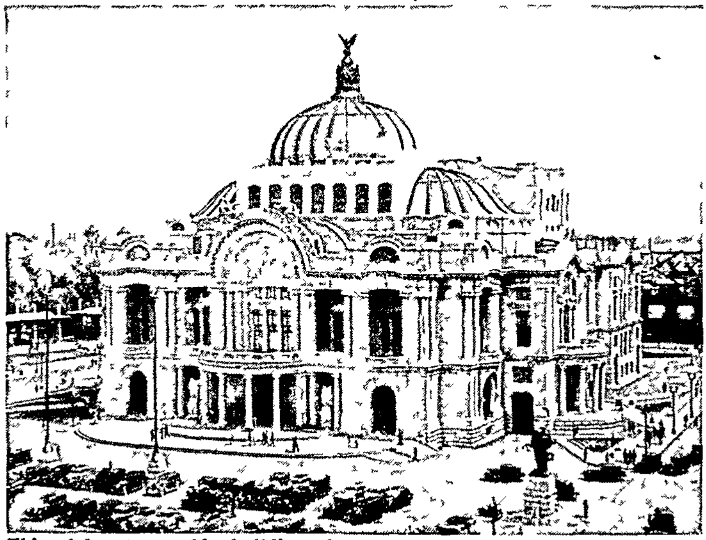
socialistic school is the "school of action." Mexican educators term it "The House of the People."

Secondary and Higher Education

The number of secondary schools is still extremely small; most of them are in the larger cities. Higher education is represented by the National University in Mexico City, founded in 1551, and the more modern and influential University of Morelia. The National College of Agriculture at Chapingo is leading the effort to improve Mexico's farming methods. In Mexico City are also the new Polytechnic Institute, the Normal School, and the Workers' University founded by Vicente Lombardo Toledano.

Friendly relations with Canada and the United States are furthered by the summer school of the National University, which is attended by almost a thousand students and teachers from the North. The Benjamin Franklin Library was organized in 1942 in Mexico City by representatives of the American Library Association and financed by the United States government. It has some 4,000 books in English and 1,000 in Spanish. Supplementing the Mexican libraries, it is an important inter-American educational link.

PALACE OF FINE ARTS, MEXICO CITY



This elaborate marble building, begun by President Díaz in 1900 and completed in 1934, contains a theater, art galleries, and a museum of popular arts. Its tremendous weight has made it settle six feet into the ground.

The Renaissance of Art

Under the patronage of the Department of Education the latent artistic talent of the country blossomed in work of great power and originality. The artists who were commissioned to decorate the new public buildings developed a school of mural painting which drew its inspiration from the hopes and dreams and struggles of the Mexican people. Diego Rivera, José Clemente Orozco, David Alfaro Siqueiros, Jean Charlot, Roberto Montenegro, and many others achieved world-wide fame. Their work stimulated in the United States a native fresco movement and contributed to the growth of regional painting, such as the Middle Western school of Grant Wood.

The children's art classes in the public schools have produced charming and original work which is winning the acclaim of painters and educators throughout the Western world.

Music, like painting, draws on native themes. Carlos Chavez, best-known composer and conductor of the Mexican Symphony Orchestra, is notable for his blending of Indian rhythms with the tempo of the modern mechanical world. His free concerts of classical music for peons and children were highly successful. Silvestre Revueltas drew his inspiration from the songs of the *mariachis* and from the *corridos.* A typically Mexican ballad, the corrido is literally a "current happening." Sung to simple catchy tunes, the doggerel verses deal with any event of historic or momentary interest. The feats of the popular revolutionary heroes Villa and Zapata were the subject of endless corridos.

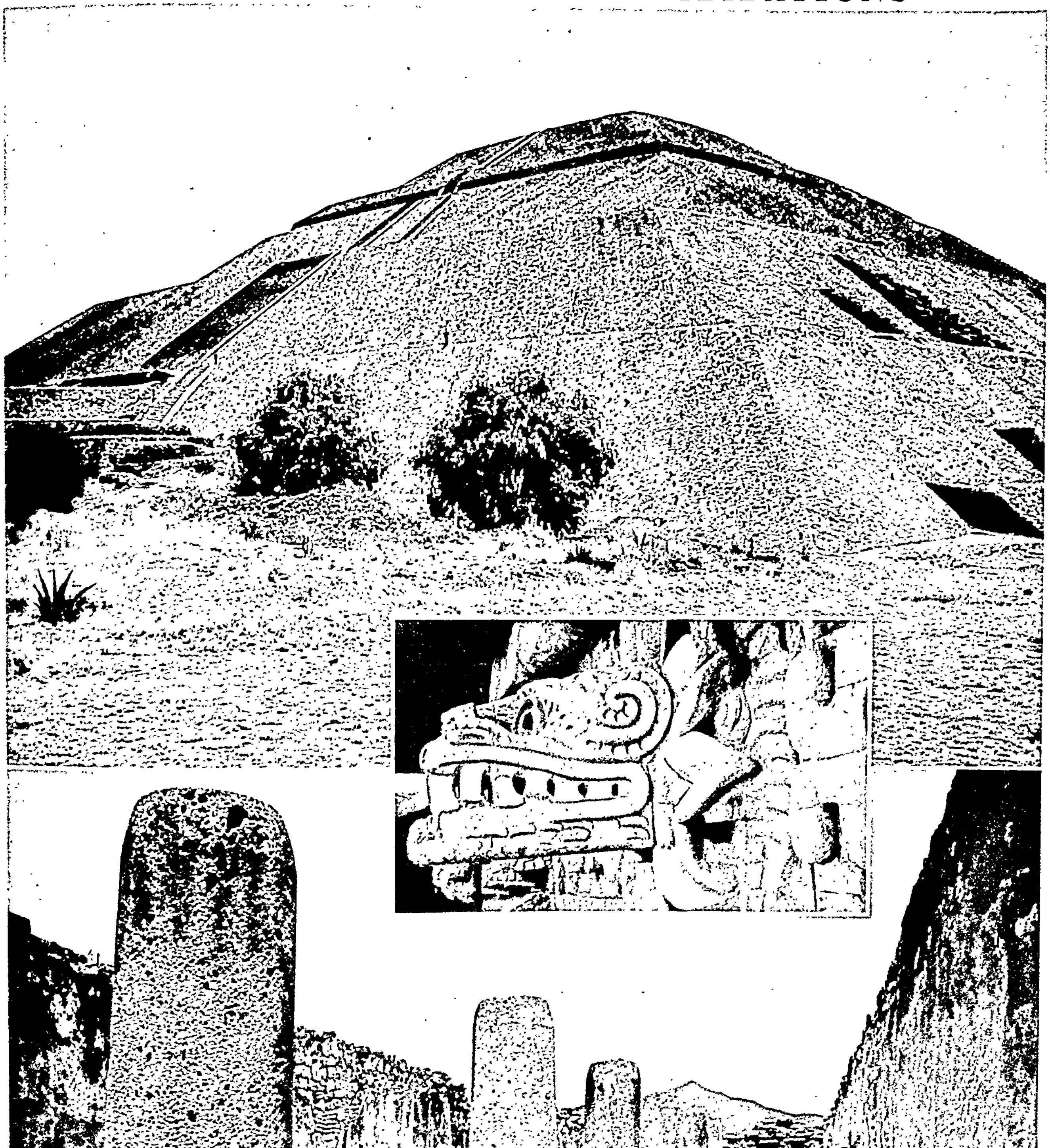
The Mexican film industry is growing in popularity throughout Latin America and is threatening the supremacy of Hollywood in those countries. It has been most successful in the field of comedy. Its outstanding actor is Manuel Moreno, the "Charlie Chaplin" of Mexico, known by the name of the character he created, the street vagrant Cantinflas. (*See also* Latin American Literature.)

History of Mexico

For centuries Mexico has been the cradle of wars—wars for possession of the scattered patches of arable land, the few dependable sources of water. The very name of the country is derived from the Aztec god of war Mexitli. It was Mexitli, so legend says, who drove away the mysterious white man, tall and bearded, who taught these primitive peoples agriculture, pottery making, weaving, and other peaceful arts. As he sailed into the East, whence he had come, he promised some day to return. The Mayas called him Kukulcan; the Toltecs and Aztecs named him Quetzalcoatl (*kĕt-săl-kō-a't'l*). They made him a god and his symbol was the plumed serpent Was he a real man, perhaps a Viking blown in his sailing vessel across the seas? Or was he a myth? History does not know, but to him was due a renewal of Mayan civilization in Yucatán after it had declined in Guatemala, Chiapas, and Honduras. Between the 4th and the 14th centuries these Indians built splendid stone cities whose ruins exist today. Mayan Indians are still the dominant racial element in Yucatán and Guatemala. (*See also* Mayas.)

By the end of the 10th century the warlike Toltecs had conquered most of central and southern Mexico Their religious capital was Tula, which is now being excavated, about 40 miles from the present Mexico City. The Toltecs built the famous Pyramids of the Sun and the Moon and the Temple of Quetzalcoatl at San Juan Teotihuacán near Tula. They also built the giant

REMAINS OF ANCIENT CIVILIZATIONS



Forty miles from Mexico City is the area known as San Juan Teotihuacān, occupying about eight square miles. Here the Pyramid of the Sun (above), 216 feet high and 720 feet square, was built by the Toltecs. On its truncated top stood a temple. In the Temple of Quetzalcoatl the decorative frieze of feathered serpent heads (inset) has been preserved. The sacred city of the Zapotecs in southern Mexico was Mitla. The Hall of the Monoliths (below) is one of its ruins.

pyramid at Cholula near Puebla. A Catholic chapel now stands on the top, on the site of the temple to the Plumed Serpent.

Contemporary with the Toltecs were the Zapotecs, who lived in the south around modern Oaxaca. The ruins of their sacred city Mitla (*mēt'lä*) are notable for their beautiful mosaic decorations in cut stone. At Monte Alban, on the hills overlooking the valley of Oaxaca, are other extensive Zapotec ruins only partially excavated. One tomb at this site yielded a treasure of exquisite jewels of marvellous workmanship. They have been exhibited in the United States and are now in the Oaxaca museum. The jewels were left there by another shadowy people, the Mixtecs (*mēs'-tĕks*), who conquered the Zapotecs and for a brief time used their tombs.

Spanish Conquest—Then Independence

By the time of the Spanish conquest (1519), all these races had been conquered and enslaved by the Aztecs (*see* Aztecs; Cortez, Hernando). The Spanish conquest was made easy by the division among these various peoples, who were united only in their hatred of the common enemy, the Aztecs.

For three centuries Spain exploited the country. Then Napoleon's aggressions and the Peninsular War in Spain (*see* Spain) gave the Latin American colonies an opportunity to revolt. On Sept. 16, 1810, the church bells of the village of Dolores began tolling. Out of the hills poured the Indians to the call of their beloved parish priest, Father Miguel Hidalgo. "Will you be free?" he demanded of them. "Will you make the effort to recover from the hated Spaniards the lands stolen from your forefathers three hundred years ago?" Once again the struggle for *land* had begun. Hidalgo led the patriots until his capture and execution by government forces, July 1811.

His banner was taken up by José María Morelos, also a parish priest, friend and pupil of Hidalgo. A stronger leader than Hidalgo, he was more successful in battle and was able to call a national congress which on Nov. 6, 1813, formally declared the independence of Mexico from Spain. In 1815 Morelos faced a royalist firing squad. The ragged remnants of his army struggled on for six years more under Vicente Guerrero waging guerrilla warfare against the royalists.

In 1821 the revolution of the liberals in Spain gave new impetus to the Mexican movement. An ambitious royalist officer, Augustin de Iturbide, deserted and, in order to acquire an army for his own purposes, joined forces with Guerrero. He proclaimed the Plan of Iguala which provided for national independence under a constitutional monarchy. The plan won the support of the conservatives, who feared the new liberalism of the home country. Iturbide was crowned emperor of Mexico in July 1822. The empire lasted 11 months. Iturbide was dethroned, exiled to Italy, and, when he returned a few months later, was put to death.

One of the leaders in the expulsion of Iturbide was General Antonio Lopez de Santa Anna, who dominated the political scene for the next 30 years. He made and unmade presidents and was himself president when Texas revolted and again when war with the United States broke out. In this war Mexico lost half its national territory (*see* Mexican War). Santa Anna's corrupt rule ended with his exile in 1855.

Fifty years of "independence" had proved a sad irony. The men who had fought for freedom had won only a new set of masters—the generals and unscrupulous politicians who served their own interests. Economically the common people were worse off than before. In 1858 a new element came to power when Benito Juarez, a full-blooded Zapotec Indian from Oaxaca, became president. He was determined to break the power of the Catholic Church in Mexico, not as a form of religion but as a political influence. By gift and inheritance the church had acquired no less than one-half of all the land and capital of the country. In 1859 Juárez issued decrees separating church and state, abolishing the monastic orders, and nationalizing all church property. It was his expectation that the lands would return to the Indians, but they were bought up by speculators.

Many years of revolution had demoralized the finances of the country. When Juárez announced a two-year suspension of payments on foreign loans in 1861, France, Great Britain, and Spain occupied Vera Cruz. Great Britain and Spain withdrew when it became apparent that the French Emperor Napoleon III was intending to overthrow the Mexican government. In the course of the struggle the French suffered defeat on May 5, 1862, whence comes the national holiday Cinco de Mayo (fifth of May). In 1864 France declared Mexico an empire with Archduke Maximilian of Austria as emperor. This was a defiance of the Monroe Doctrine, which France would not have attempted had not the United States been occupied with the Civil War. At the close of the war, Gen. Philip Sheridan marched to the Rio Grande, whereupon the French troops withdrew from Mexico. Maximilian was executed June 19, 1867.

The Régime of Porfirio Díaz

One of the military leaders in the struggle against the French was Porfirio Díaz, a mestizo. In 1876 he overthrew the successor of Juárez and the following year secured the presidency for himself. A new era was to begin for the storm-tossed nation. Except for the years 1880 to 1884, when a man of his own choosing was president, Díaz was absolute dictator for more than three decades. On the surface it was a golden age of peace and plenty. Díaz established order and persuaded foreign capital to develop the national resources. He increased the national income from 19 to 100 million dollars; multiplied imports eight times and exports five times; increased gold and silver mining from 25 to 160 million dollars annually; and extended railway mileage from 400 to 15,000 miles.

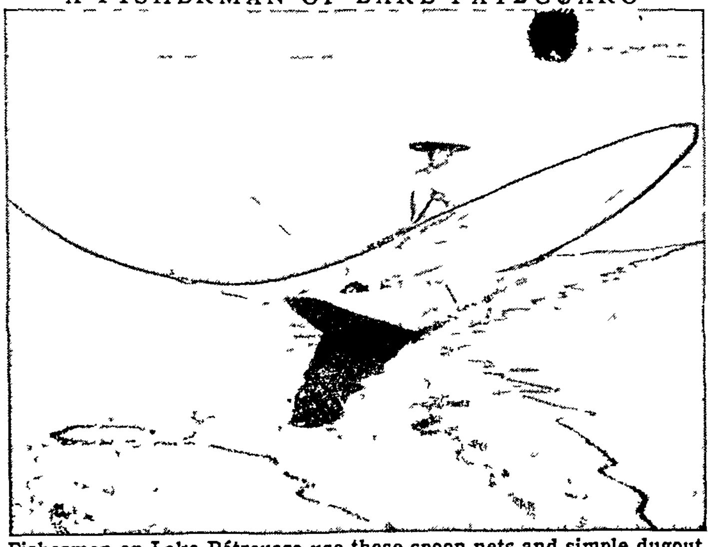
The other side of the picture is not so attractive. There was no law but the will of Díaz. He referred to his legislature as "my herd of horses." To foreign

speculators and personal friends he gave one fifth of the entire area of the country.

The Beginning of the Revolution

As the aging Díaz gradually relinquished his personal grip on public affairs, the clouds of war again began to gather. Francisco I. Madero, the son of a rich and powerful family, wrote a book entitled 'The Presidential Succession in 1910', in which he mildly criticized the Díaz régime. The book won considerable attention. Political clubs were formed and newspapers established to express his views. In 1910, following the elections, revolution broke out and Madero captured the city of Juárez on May 9, 1911. He forced Díaz to resign the presidency and was himself elected on a platform which promised the single presidential term and reforms in the suffrage, land distribution, and freedom of the press.

A FISHERMAN OF LAKE PÁTZCUARO



Fishermen on Lake Pátzcuaro use these spoon nets and simple dugout canoes. Living on the shores are Tarascan Indians.

Madero was idealistic and sincere but a poor executive. His brief presidency was chaotic. Felix Díaz, nephew of the dictator, headed a revolt in Vera Cruz. One of Madero's generals, Victoriano Huerta, rebelled against his chief. Madero lost the support of the disappointed masses who demanded agrarian reforms. Huerta and Díaz joined forces to overthrow him, and on Feb. 22, 1913, he and his vice-president, Pino Suárez, while in military custody, were brutally murdered.

Huerta now became provisional president. Counter-revolutions flared throughout the north under the leadership of Venustiano Carranza, a Madero adherent and governor of the state of Coahuila, and his generals Francisco ("Pancho") Villa, Alvaro Obregón, and Pablo Gonzáles. In the south Emiliano Zapata was leading the disillusioned peasants in raids on the sugar plantations. Up to this point the revolution had been formless and inarticulate. Leaders sprang up independently in widely separated parts of the country, gathered about them ragged unarmed peasants, and provisioned them off the country. The peasants knew only that they and their children were hungry, had been hungry always.

A TYPICAL "ZAPATISTA"

Peons of the south, like this old man, fought with Emiliano Zapata.

Zapata was the first to define the fundamental issue at stake. His war cry was "Land and Liberty," his objective the return of the haciendas to the people. He became the symbol of the revolution, the idol of the people. Innumerable tales and songs sprang up around his exploits.

Huerta regained some of his popularity in his own country when he defied the power of the United States after the so-called Tampico Incident in the spring of 1914. Sailors from the United States gunboat *Dolphin*, who had gone ashore at Tampico for supplies, were arrested by Mexican police. Admiral Mayo demanded an apology and a salute to the flag. Huerta apologized but refused to salute. The incident was used as an excuse to capture Vera Cruz to prevent the landing of munitions for Huerta from a German steamship. War was averted by the mediation of Argentina, Brazil, and Chile.

Period of Disorder and Confusion

The United States, by preventing supplies from reaching Huerta and by allowing munitions to reach his enemies Carranza and Villa, succeeded in overthrowing Huerta, and Carranza became president. In the meantime Carranza and Villa had quarreled, and Villa became a rebel chieftain. In 1916 he raided Columbus, N. M., killing a number of Americans. General Pershing was sent into Mexico at the head of a punitive expedition, but Villa escaped.

After the entry of the United States into the first World War, Mexico became a center of German intrigue. Germany even went so far as to propose, in the famous "Zimmermann note," to help Mexico invade the United States.

Under Carranza the Constitution of 1917 was adopted. Now at last the program was crystallized. The Constitution is the "blueprint" of a modern socialistic nation. The convention that drew it up is considered by many historians the most important single event of the revolution. It sharply divides the revolution into two periods. Before 1917 it was a chaotic struggle to destroy the evils of 400 years of feudalism. Since 1917 it has been a

struggle to put into effect the ideals written into the Constitution. The most important clauses, relating to land, labor, subsoil resources, and education, have already been discussed.

Carranza won many enemies by failing to push the revolutionary program, and in 1920 he was murdered. General Alvaro Obregón became president. Obregón soon proved to be the strongest man Mexico had produced since Díaz and the first who was both willing and able to put through badly needed social reforms. For eight years Obregón dominated Mexico, since his successor to the presidency, Gen. Plutarco Elias Calles, was elected by his influence and remained in political alliance with Obregón throughout his administration, 1924–28.

Calles' drastic enforcement of the antichurch laws and the mineral and land laws led to widespread revolt at home and serious troubles with foreign governments. Through the skillful diplomacy of the United States ambassador Dwight Morrow, he was persuaded to adopt a more friendly attitude toward foreign powers and to reopen the churches. The superb Diego Rivera frescoes in the Cortez Palace of Cuernavaca were commissioned by Morrow as a personal expression of his affection for Mexico. More than any other American ambassador he soothed the resentment against American interference in Mexican affairs and the still bitter memories of the Mexican War.

ADMIRING A PAINTING OF THE REVOLUTION

This mural painting in Chapultepec Castle shows the early heroes of the revolution. On the white horse is Francisco Madero, who led the revolt against President Díaz. Behind him, with white beard, is Venustiano Carranza, one of his generals, who became president of the republic. The banners read: "Land and Liberty" and "Land for All."

Obregón was again elected president after Calles but was assassinated by a religious fanatic in 1928. Calles now exercised chief political power as founder and head of the strong National Revolutionary party (PNR). He brought about the election of Emilio Portes Gil as provisional president; placed Pascual Ortiz Rubio in the presidency in 1930; forced him to resign in 1932; and put Abelardo Rodriguez in his place.

Period of Peaceful Reforms

In 1934 he supported Gen. Lázaro Cárdenas, a mestizo with Tarascan Indian blood. Cárdenas, however, was no puppet. He expelled Calles from the country and vigorously developed the Six Year Plan for socializing the nation which had been drawn up by PNR.

In six years Cárdenas distributed more land to the peasants than had been done in all the preceding years He built up the rural schools, nationalized the oil lands, encouraged and strengthened the labor unions

These reforms caused a major economic depression The difficulties over oil seizures cut off a major source of government revenue and forced curtailment of public works. Wages could not keep pace with the soaring cost of living, and labor suffered severely

The regime of President Manuel Avila Camacho (1940–46) opened with a promise of moderation Friendly relations with the United States were signalized by the presence of Vice-President Henry A. Wallace at the inauguration.

On June 1, 1942, after several Mexican ships had been sunk by Axis submarines, Camacho declared war on Germany, Italy, and Japan. Mexico cooperated in hemisphere defense and used United States capital to help increase its production of raw materials. Miguel Alemán succeeded Avila Camacho as president in 1946. In 1947, President Truman made a "good will" visit to Mexico. A few months later, President Alemán visited Washington, D.C., where he obtained a loan of 100 million dollars for industrial development The World Bank in 1950 extended a 10-million-dollar credit to help finance small business enterprises. President Alemán promoted huge public works. Notable are the dams in the Papapoloapan Valley—Mexico's TVA in the heart of the jungle—and the new University City on the outskirts of Mexico City. Adolfo Ruiz Cortines was elected in July 1952 to succeed President Alemán for a six-year term beginning December 1. The profitable tourist industry reached a new peak in 1954 with devaluation of the peso.

Organization of the Government

A federative republic, Mexico is divided into 29 states, 2 territories, and a federal district. Its president is elected for six years and cannot succeed himself. The bicameral legislature appoints a permanent committee of 14 senators and 15 deputies to serve between sessions of Congress. (*See also* Díaz, Porfirio; Latin America; Latin American Literature; Mexico City).

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MEXICO CITY, MEXICO. The capital of Mexico is the oldest city in North America, for it is a continuation of the Aztec city of Tenochtitlán, founded about 1325 (*see* Aztecs). Like Washington, D.C., it is included in a federal district (*Distrito Federal*) and is identified officially as México, D.F.

The city lies in a fertile valley 7,500 feet above sea level. Visible to the southeast are the snow-crowned peaks of Popocatépetl and Ixtaccíhuatl. East of the city stretches a flat plain, once the bed of numerous lakes. Rivers flowing into these lakes used to cause disastrous floods, for the Valley of Mexico had no natural outlet to the sea. In 1900 the great 30-mile Canal del Desagüe was cut through the mountains on the north to a headstream of the Pánuco River. This canal with its many branches now drains the lake area into the Gulf of Mexico and removes the sewage of the city. All that remains are the shallow water flats of Lake Texcoco on the east, and Lake Xochimilco. The old lake beds are devoted to truck gardening and the raising of dairy cattle, and the canals carry the small flat-bottomed boats of the produce merchants and the Sunday picnickers.

Mexico City's high altitude offsets its tropical location and gives it a mild and uniform climate. The rainy season from June to November is not unpleasant, for the rains usually occur in late afternoon and evening in downpours of short duration.

Historic Heart of the City

The nucleus of the city is the Plaza Mayor de la Constitución, popularly called the Zócalo. Here are the splendid public buildings—the Cathedral, the National Palace, the Municipal Palace, and the Arcades of the Tradesmen—all built shortly after the conquest in the 16th century on the site of the Aztec temples and palaces. At the northeast corner of the square in a deep excavation may be seen a section of the foundations of the Aztec Teocalli, a pyramid with decorations of huge stone dragon heads. Attached to the National Palace is the National Museum, a treasure house of Mexican archeology. One of its most precious relics is the Aztec Calendar Stone (*see* Aztecs). This old part of the city around the Zócalo has many beautiful buildings and churches of colonial Spanish architecture. Near by, too, is the modern Ministry of Education, famous for its mural paintings by Diego Rivera, and the National Preparatory School with murals by José Clemente Orozco.

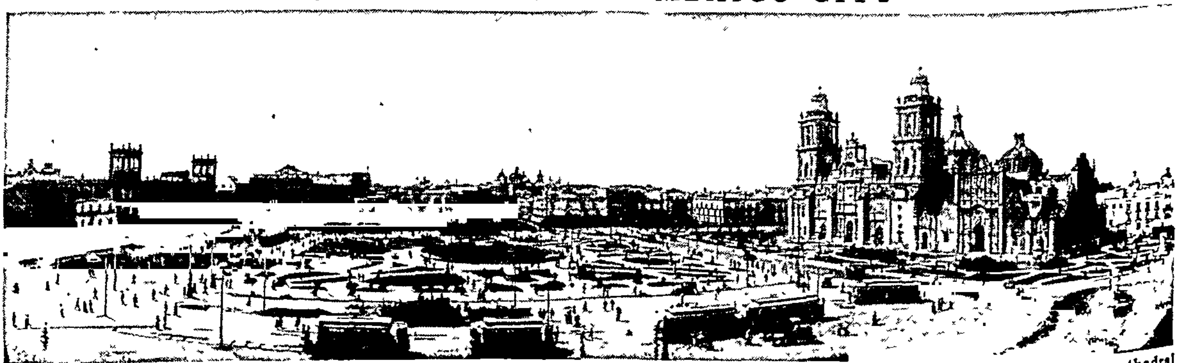
West of the Zócalo, in the heart of the business district, is the Alameda, a large plaza flanked by the ornate white marble Palace of Fine Arts and by modern skyscrapers. A few blocks west of the Alameda is the Monument to the Revolution. The monument is a massive structure, 250 feet high, of marble and stone arches supporting a copper dome. On the corners of the arches below the dome are allegorical sculptures representing the labor, reform, and agrarian laws, and independence.

Paseo de la Reforma and Chapultepec

Near the monument begins the beautiful Paseo de la Reforma, a broad tree-lined avenue which sweeps in a straight line three miles southwest to Chapultepec Park. It was planned by Emperor Maximilian to resemble the Champs Elysées in Paris. At intervals along the way are circles containing gardens, fountains, and monuments. Chapultepec was a pleasure park in the days of the Aztec Montezuma. Moss-covered *ahuehuetes*, giant cypress trees hundreds of years old, line the many walks and drives. On Sundays the park is filled with families who bring their lunches and listen to the concerts by the *Orquesta Típica* and watch the performances of the *charros*. These are men who dress in traditional costume and give demonstrations of riding skill on superbly trained horses. They are members of an exclusive club whose purpose is to keep alive the dress and customs of an earlier day. Chapultepec Castle surmounts a hill in the park. (*See also* Mexican War, Mexico).

The city is growing rapidly and suburbs of doubtful architectural merit reach out in all directions. Many of the adobe hovels of the laboring people are being replaced by government-built small apartments. Industries are increasing in number and importance, and the development of electric power within recent years

IN THE HEART OF MEXICO CITY



The Plaza Mayor de la Constitución, better known as the Zócalo, is the historic heart of the city. At the right stands the cathedral on foundations laid in 1573. It occupies the site of a great Aztec pyramid and temple, the Teocalli, where human sacrifices were offered. This picture was made from the National Palace, which flanks the entire east side of the square. It houses the government offices. Over its main gateway is the "Liberty Bell" of Mexico, first rung Sept. 16, 1810, by Miguel Hidalgo, who led the revolt that ended in the overthrow of Spanish rule. On every anniversary of this event, at midnight, the bell is rung by the president.

has helped manufacturing. Among the leading products are textiles, leather, boots and shoes, paper, pottery, tobacco, soap, liquor, flour, and furniture.

Mexico City was founded about 1325 by the Aztecs, who built a village of mud and rush dwellings on little islets in Lake Texcoco. First called Tenochtitlan, and later named Mexitli in honor of the god of war, it grew with the increasing power and civilization of its inhabitants. In the 15th century the rude dwellings were replaced by stone structures. The town had reached the height of its glory when the Spaniards under Cortez practically destroyed it in 1521. It was rebuilt by the Aztecs under the direction of the conqueror. In the Mexican War of 1846–48, the city was captured by the United States troops under the leadership of Gen. Winfield Scott and was held until the signing of the armistice. Population (1950 census, preliminary), 2,233,914.

MIAMI, FLA. The enterprising H. M. Flagler in 1896 extended the East Coast Railway down to an old Indian trading post squatted at the edge of a mangrove swamp on Biscayne Bay at the southern tip of Florida. Next to the little Indian storehouse he built the Royal Palm Hotel, and almost overnight the magic city of Miami grew up. In 1925 and 1926, during the Florida real estate boom Miami's population almost doubled. Skyscrapers and huge hotels sprang up with bewildering speed. Although a tremendous hurricane swept through the city in 1926, wrecking new homes and buildings and destroying property worth millions of dollars, all its traces were soon erased.

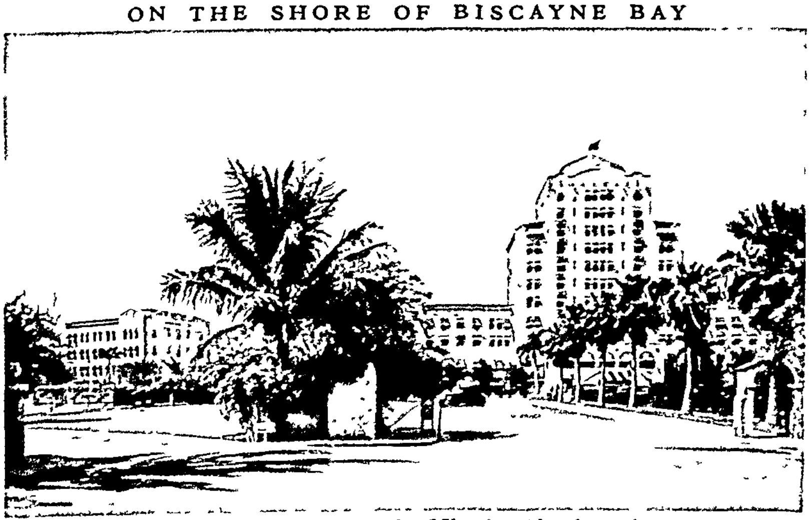
Its mild subtropical climate has made Miami a famous year-round playground. The tourist trade yields a large annual income. Every facility is offered for golfing, yachting, fishing, bathing, polo, and other sports. Sailfish, tarpon, and many other game fish try the skill of fishermen. Three causeways across Biscayne Bay connect the city with Miami Beach, which stretches for eight miles along the ocean. On the 15-mile palm-fringed boulevard that parallels the bay is beautiful Bay Front Park, with its huge amphitheater. The University of Miami, opened in 1926, has an attractive setting in Coral Gables.

Fish, Fruit, and Manufactures

Miami has large commercial fisheries and rapidly growing manufactures. Boatbuilding, lumber industries, foundries, glass works, dredging, paint manufactures, grapefruit canning, and tanning of snake and alligator skins keep its workers busy. The city ships large quantities of tropical and subtropical fruits—grapefruit, oranges, pineapples, limes, guavas, avocados, mangoes, coconuts—and early vegetables.

Many airlines serve its international airport. It is one of the world's busiest, with daily service to Latin America. Miami is also an important seaport. A canal from Miami River to Lake Okeechobee gives Miami an inland waterway through the rich fruit and vegetable growing regions of the reclaimed Everglades. It is also on the Intracoastal Waterway, an inland channel along the east coast of the state, and is linked with Tampa by the Tamiami Trail, a highway which crosses the Everglades. Two railroads serve the city. Miami adopted the city-manager form of government in 1921. Population (1950 census), 249,276.

ON THE SHORE OF BISCAYNE BAY



This is one of the palm-lined drives that give Miami and its sister city, Miami Beach, their pleasant semitropical atmosphere. In the background is a good example of the architecture that is popular throughout Florida.

MICA. A piece of this mineral an inch thick can be split into nearly a thousand sheets, each as thin as the thinnest tissue paper. For its familiar use in the doors of stoves and as chimneys for incandescent gas-burners, it is split into sheets about as thick as heavy paper. These sheets are tough, elastic, and resistant to heat, and those made from the variety of mica called "muscovite" are almost as transparent as glass. The name muscovite, or muscovy glass as it used to be called, came from the fact that this mica was formerly in common use for windows in Russia.

The chief use of mica today is as a dielectric in small electrical condensers, such as are used in radio apparatus (*see* Electricity). Broken into small sparkling bits it is used as spangles to give glittering effects to stage costumes and scenery. This use recalls the origin of the the word mica, which comes from the Latin word *micare,* meaning "to glitter."

All the varieties of mica are silicates of aluminum and other elements; that is, they are compounds of silicon and aluminum with other things in minor quantities. Muscovite also contains potassium. Most of the world's supply of sheet mica comes from India, but the United States and Canada furnish most of the "scrap" mica. In North Carolina, the richest field in the United States, much of the mining is done in primitive fashion by farmers, who trade it to the storekeepers. New Hampshire also has valuable mica lands in the White Mountains. Mica is found in shades of yellow, green, brown, red, and black.

MASTER GENIUS *of the* RENAISSANCE

MICHELANGELO (*mī'kĕl-ăn'ġĕ-lō*) BUONARROTI (1475–1564). On a scaffolding sixty feet above the floor of a chapel in Rome lay a man, painting with furious strokes on the wet plaster of the ceiling which stretched its ten thousand square feet of surface about him. It was Michelangelo, the greatest genius of the Italian Renaissance, who between the years 1508 and 1512 frescoed the vault of the Sistine Chapel with hundreds of titanic figures embodying his vision of the world's creation.

Today we gaze in awe at the nine main scenes depicting the story of Genesis from the Creation to the Flood. We see many other scenes showing the ancestry of Christ, stirring moments of Biblical history, and the ancient prophets and the pagan sibyls dreaming of the good that was to come to the world.

When we consider the vast size of this enormous mural, its majestic vigor and variety, and the stupendous difficulties of the task, we are astounded to think that it could have been accomplished by the almost unaided powers of one man. We understand why artists call this "the most extraordinary piece of technical work ever accomplished."

The majestic 'Moses', in the Church of San Pietro in Vincoli, Rome, is generally agreed to be Michelangelo's masterpiece. The Lawgiver, with the tablets of the Law by his side, is represented at the moment when he sees the people of Israel dancing around the Golden Calf. Wrath, indignation, and pain are frozen on his face.

Not only are we thrilled by Michelangelo's lofty conception and by his masterly technique, but we are also stirred by his indomitable will and almost superhuman energy. We marvel at the courage with which he bore the "great hardships, illness, and overwhelming labor" that accompanied this work. His difficulties were extraordinary. The huge figures had to be painted while he sat or lay in so cramped a position that for months afterward he could not read "except in the same attitude of looking upwards." The assistants whom he engaged were unequal to the task of carrying out his designs, and he had to carry out the whole vast design with his own hand. To the difficulties of the work itself were added harassing worries caused by intriguing rivals, money troubles, and the constant demands of his grasping brothers.

When we think of these difficulties we marvel how anyone could have surmounted them and created this perfect work. In it, as a great critic says, "the artist's spirit appears at its noblest dignity, in its highest purity."

The Buonarroti were a poor but noble family of Florence. Michelangelo was born March 6, 1475, at Caprese, a small town of which his father was then mayor.

The boy grew up in Florence, which was the art capital of Italy, and early showed a great fondness and talent for art. He spent all his leisure in drawing and painting and was so set on becoming an artist that his father was forced, against his will, to apprentice him to the painter Ghirlandaio.

Michelangelo was then only 13, but his work was so promising that within a year he was chosen for admittance to the new art school established by Lorenzo de' Medici in the Medici gardens. Here, amid Lorenzo's collection of Greek and Roman statues, Michelangelo learned the art of sculpture. He copied the head of a laughing faun with such skill that his patron took him to live in the palace. For three years, until Lorenzo's death, the youth worked untiringly, producing some fine pieces which are still preserved.

THREE OF MICHELANGELO'S GREATEST WORKS

At the top is 'The Creation of Adam' in the Sistine Chapel of the Vatican, one of a group of ceiling frescoes which present the story of Genesis from the Creation to the Flood. The circle shows 'The Holy Family', in the Uffizi Gallery at Florence, the only easel painting by Michelangelo left to us. At the right is the 'Madonna della Pietà', which stands in the Church of St. Peter in Rome. It was carved in the artist's youth and is the only work on which he placed his name.

Two years later he was in Rome, where he was commissioned to carve a *Pietà*, a marble group representing the Virgin Mary supporting the dead Christ on her knees. This masterly group, known as 'The Madonna della Pietà', won him instant recognition as the greatest sculptor of his time.

Returning to Florence at the age of 26, Michelangelo was commissioned to make a giant statue out of an 18-foot marble block which another sculptor had clumsily roughed out years earlier and then abandoned. For more than two years Michelangelo labored continuously in a wooden shed built around this block. Out of its colossal mass, with all the limitations of its previous shaping, he hewed his youthful courageous 'David'—one of the world's greatest statues.

The year 1505 found Michelangelo again in Rome, this time at work on a tomb for Pope Julius II. It was to be a huge structure with some 40 statues arranged in three tiers. The artist threw himself heart and soul into the scheme, even spending many months in the marble quarries at Carrara to select blocks of unusual beauty and quality, and free from flaws, that would fit his designs. But new orders from the pope, political upheavals, jealousies, and changes of plan after the pope's death interfered with the work.

Forty years later, Michelangelo had completed only a few figures for the much reduced tomb Among them were the majestic 'Moses', which is part of the memorial as it appears today, and the 'Slaves', now in the Louvre.

By common consent, these are among the supreme triumphs of the sculptor's art. With them rank the figures of Dawn and Dusk, Night and Day, and the portrait statues for the Medici monument in Florence.

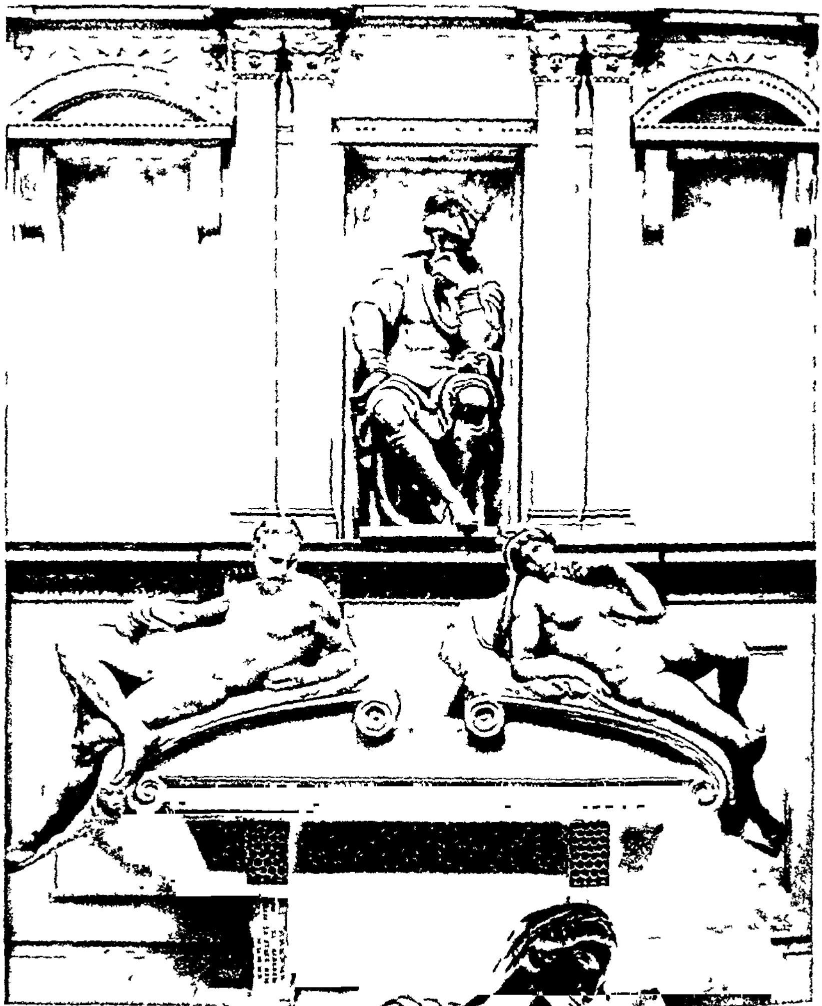
More than 20 years after he did his ceiling frescoes for the Sistine Chapel, Michelangelo began to paint his enormous 'Last Judgment', 60 feet in height, on the wall of the chapel behind the altar. In its vast proportions, technical excellence, and daring conception it is a fitting companion for the ceiling paintings. It has been called the most famous single picture in the world.

Besides these masterpieces, Michelangelo left the world many other significant works in both painting and sculpture. Nor did these twin arts absorb all his many-sided genius, for Michelangelo used his vast powers in many fields. When his beloved Florence was in danger, he superintended its fortification. He wrote a collection of impassioned sonnets, which in their impetuosity and vigor remind us of his work in marble. And finally, he left us the greatest architectural achievement of the Italian Renaissance, the dome of St. Peter's, a labor of love designed during his last years.

"Death plucks me by the cloak," he cried when he was 89 years old, and only then were his tireless hands stilled. He was buried in the church of Sante Croce at Florence, Italy's "Westminster Abbey."

Michelangelo outlived his illustrious contemporaries Raphael, Leonardo da Vinci, and Correggio. Except for Titian, he was the last great figure of Italy's golden age of art. A stern and lonely dreamer, in the loftiness of his inspiration and in the number and variety of his immortal works Michelangelo still stands unrivaled. In him were summed up the vigor of mind and body, the restless energy, the boldness of spirit, the freedom of action, the curious combination of worldliness and religious zeal, which mark that great period. (*See also* Renaissance.)

MONUMENT TO THE MEDICI FAMILY



Above is one of the two famous tombs in the Chapel of San Lorenzo in Florence. It is that of Lorenzo, Duke of Urbino, grandson of Lorenzo the Great His seated figure symbolizes Thought and the reclining figure of the man, Dusk, and of the woman, Dawn. The head of Dusk is a self-portrait of the artist. Also in the Chapel is his 'Virgin and Child' shown below.

MICHELSON (*mī'kĕl-sŏn*), ALBERT A. (1852–1931). A class in physics at the United States Naval Academy gathered around a youthful teacher one day back in the 1870's. His simple apparatus consisted of odds and ends salvaged from a laboratory junk heap, with a small revolving mirror purchased for ten dollars. With this crude equipment the instructor conducted the experiment which resulted in the most accurate measurement made up to that time of the velocity of light. The instructor was Albert A. Michelson, who became one of the greatest physicists of all time and won world fame for his study of light and for his experiments bearing on the existence or non-existence of ether in space.

The invention of the Michelson interferometer, and of the echelon spectroscope, which gives immensely detailed spectrums (*see* Spectrum and Spectroscope); the first accurate measurement of the rigidity of the earth; and the measurement of the diameter of stars with the interferometer, were among his other notable achievements.

ALBERT A. MICHELSON

One of America's Greatest Physicists

Michelson was born Dec. 19, 1852, in the Prussian town of Strelno. When two years old, he was brought to America by his parents, who journeyed across the western prairies to Virginia City, Nev., in a covered wagon, and a few years later moved on to San Francisco. His father decided that after his graduation from a San Francisco high school young Albert should go to Annapolis and become a naval officer. The 17-year-old boy went to Washington and persuaded President Grant to give him a special appointment to the Academy. He was graduated in 1873, then served two years as a midshipman. In 1875 he was made instructor of physics and chemistry at the Academy.

Michelson's measurement of the speed of light corrected the careful determinations made by the learned French physicists, Fizeau and Foucault. Stimulated by this success, he went to Europe to study physics for two years at Berlin, Heidelberg, and Paris. Returning to America, he became professor of physics at the Case School of Applied Science in Cleveland, Ohio. There he invented the Michelson interferometer, an instrument by which light waves may be measured to within a millionth of an inch (*see* Light). With this new instrument and in collaboration with E. W. Morley, he conducted the famous Michelson-Morley experiment on ether-drift, to determine the absolute speed of the earth in respect to the ether—the hypothetical stuff physicists believed pervaded all space.

The test was made by sending out simultaneously two beams of light—one in the direction of the earth's motion, and the other at right angles to the path of the first light wave—and by means of mirrors, reflecting each of the beams back along its own path to the starting point. The presence of ether-drift would have slowed up the beam moving in the direction of the earth's motion so that the waves of the two beams would return somewhat out of step with each other; but the beams sent out by Michelson and Morley came back exactly in step, indicating that there was no ether-drift, and, perhaps, no ether (*see* Ether.)

The negative result of this experiment suggested the need for new conceptions in physics and led to the famous relativity theories of Albert Einstein (*see* Relativity). The experiment therefore ranks in importance with Galileo's tests of gravitation.

In 1889 Michelson became professor of physics at Clark University, in Worcester, Mass., where he further developed the application of the interferometer in the measurement of distances. Three years later he was invited to carry on his work at the International Bureau of Weights and Measures at Sèvres, France, to the end of determining the length of the standard meter in terms of the wave length of light. After one year of careful observation and experimentation, Michelson found this platinum-iridium stick to be equal to 1,553,163.5 times the wave length of a certain red line in the spectrum of the metal cadmium, with an absolute accuracy of one part in 2,000,000. If the standard meter is ever lost or destroyed, it can now easily be reproduced, since the length of light waves is constant.

In 1892 Michelson was made head of the department and professor of physics at the University of Chicago, remaining there until 1929, when he retired to check again the speed of light. His experiment of 1926, in which he timed a beam of light from Mount Wilson to San Antonio Peak in California, a distance of 22 miles, gave 186,284 miles per second as the speed. Michelson wanted still greater accuracy. When his instruments were in place and the first tests started in a mile-long vacuum tube near Pasadena, Michelson was stricken by paralysis. He directed further work, however, through assistants, until he died May 9, 1931. The final results of the experiment were published in 1935 (*see* Light).

Michelson received honorary degrees from many universities of both Europe and America, and in 1907 he won the Nobel prize for physics, the first American to receive this honor. That same year he was awarded the Copley Medal, the most distinguished honor bestowed by the Royal Society of Great Britain.

The "WOLVERINE" STATE *with Its Twin Peninsulas*

MICHIGAN. If you were asked to name the states of the Union which have the longest coast lines, you would probably think only of the states that border on the ocean. However, the coast line of the inland state of Michigan ranks second in length. It stretches along the Great Lakes for 3,121 miles (mainland 2,242 miles and islands 879 miles). Only Florida has a longer general coast line (3,751 miles; mainland 1,987 miles and islands 1,764 miles). Michigan has such a long coast line because it is made up of two big peninsulas. These are a northern (upper) peninsula and a southern (lower) peninsula. Together they separate Lakes Superior, Michigan, and Huron.

History tells why these two different and separate peninsulas were united into one state. In 1835 Michigan, not yet a state, was at the point of war with Ohio because each claimed a strip of land at the south of Michigan. In 1836 Congress decided to give that strip of land to Ohio and offered to include the upper peninsula in Michigan as compensation. Michigan accepted these terms and was admitted to the Union as a state Jan. 26, 1837.

How the Upper Peninsula Rewarded Michigan

The immense mineral wealth of the new region was then unknown, and because of its rugged rocky character people thought it was of little value. In Congress Henry Clay opposed the project for the construction of the Soo canal at the point where the St. Marys River separates the upper peninsula from Canada. He said that these straits were "beyond the remotest settlement in the United States, if not in the moon." Today the canals around the rapids of the river usually carry more traffic than the Panama and Suez canals combined (*see* Sault Sainte Marie).

The upper peninsula stretches east and west between Lake Superior and Lake Michigan. Its eastern half is low and often swampy, particularly along the Tahquamenon River. In the western half the peninsula rises sharply to a tableland containing the Huron and Porcupine Mountains. This peninsula is one of Michigan's greatest sources of wealth, for it is part of the rich Lake Superior iron and copper country, which spreads over Michigan, Wisconsin, and Minnesota.

The copper deposits lie wholly in the state of Michigan. They are unique in that they are the only large deposits in the United States where copper occurs chiefly in pure metallic form. For many years Michigan was the greatest copper-producing state, but it now usually ranks sixth. In 1953 a mine at White Pine near Houghton began producing chalcocite ore, containing a small percentage of copper, from one of the largest undeveloped copper ore bodies on the continent. In the mining of iron ore, the state's chief mineral, Michigan is surpassed only by Minnesota. The timber resources of the upper peninsula have also contributed enormously to Michigan's wealth.

The Many Resources of the Lower Peninsula

The rolling lower peninsula, which projects north between Lakes Huron and Michigan in the shape of a huge mitten, has resources of no less importance, though different. Here are rich farm and fruit lands, the nation's greatest salt wells, and great deposits of limestone, clay, sand, gravel, and gypsum. There is some coal, but its production is small. Petroleum has become the state's second most valuable mineral since oil discoveries in Saginaw County in 1925.

Along Lake Michigan is a *fruit belt*, some 30 miles wide, where apples, peaches, pears, plums, cherries, grapes, and small fruits are grown in abundance, thanks to the prevailing winds from Lake Michigan. In the spring these winds tend to prevent early budding of the fruit trees and the consequent danger of destruction of the crop by late spring frosts. In the summer they prolong the growing season and thus give the fruits time to ripen.

The farm lands produce large crops of corn, hay, oats, wheat, potatoes, and dry, edible beans. The Michigan celery beds are famous throughout the nation, and the state is one of the chief sources of supply for peppermint, used in chewing gum and for other flavoring. It is also one of the leading states in making beet sugar and in raising truck garden crops.

Michigan's Thriving Industries

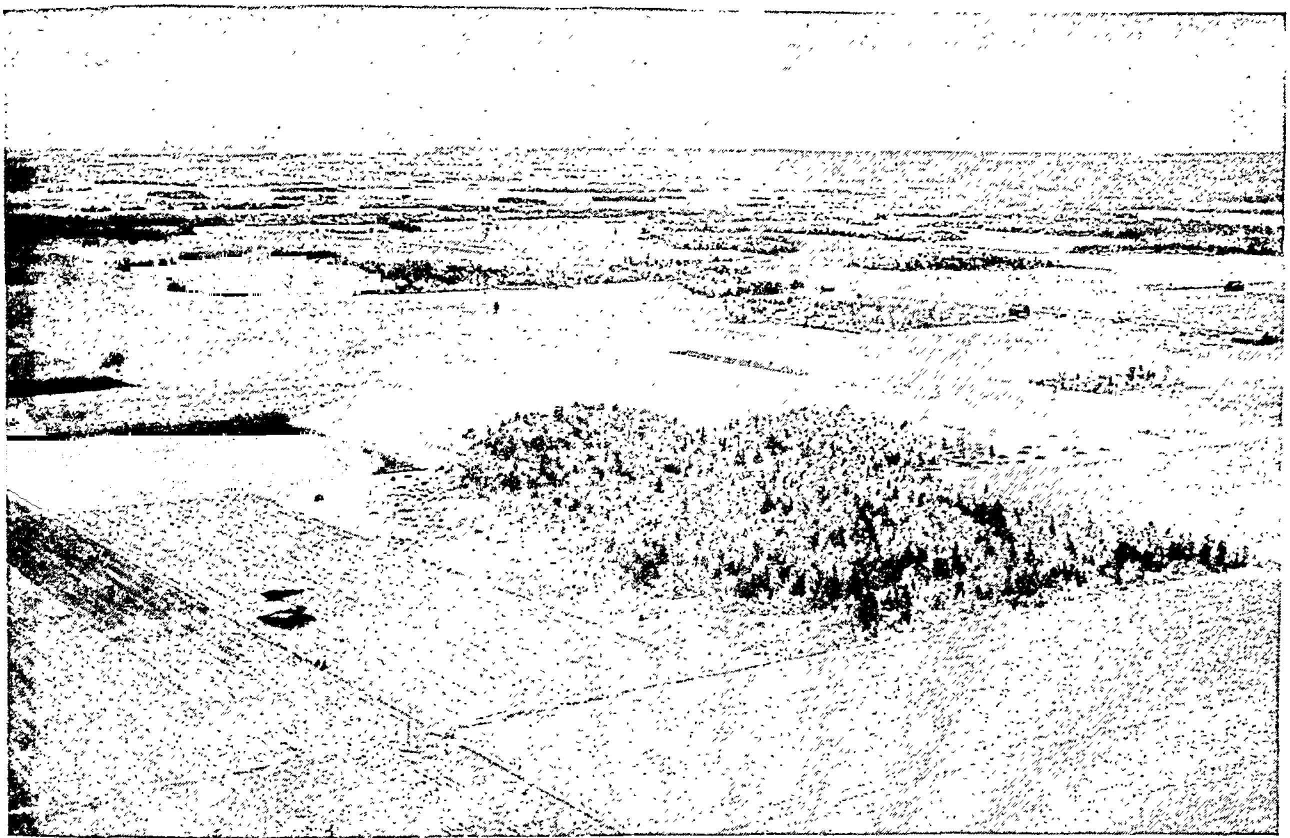
A generation ago Michigan was the chief lumber state in the Union, but this industry has greatly declined, as the forests of both hard and soft woods were cut wastefully without regard for the future. Cities such as Saginaw, which owed their rise to the lumber industry, have become general manufacturing centers (*see* Saginaw). Large forest preserves, however, have been set aside in order that the timber industry can be partially revived.

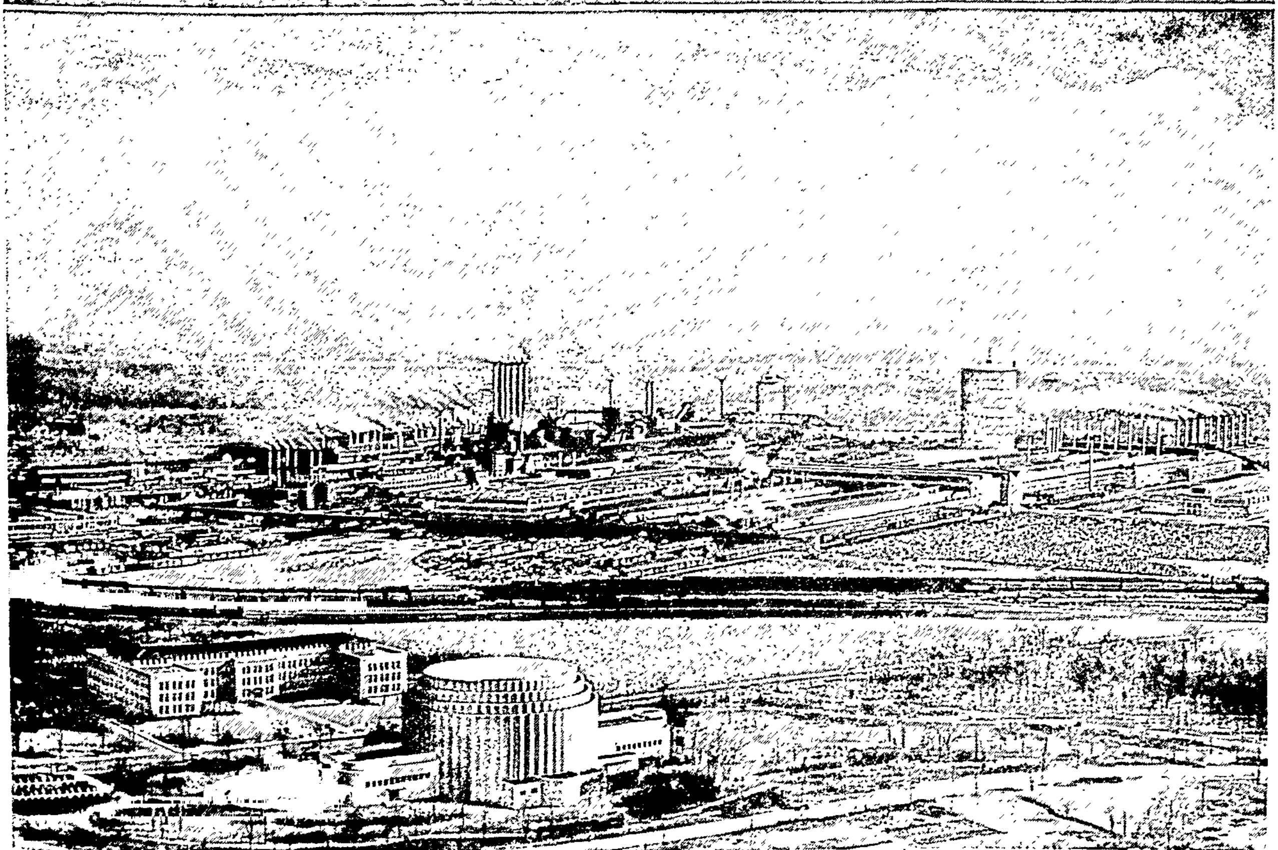
These vast resources of minerals and lumber, combined with cheap transportation on the Great Lakes, have made Michigan one of the great manufacturing states. Metal forms the basis of the largest manufactures. The automobile industry leads all the rest. More than half the automobile output of the country comes from this state, and Detroit is the automobile capital of the world (*see* Detroit).

Flint, Dearborn, Lansing, and Pontiac are also important automobile producers (*see* Flint; Dearborn; Lansing). One out of every five industrial workers in Michigan works for the automobile industry. Steelworks, rolling mills, and iron foundries are located near the automobile factories along Lake Erie and the Detroit River. They supply much of the steel and other metals used in making motor vehicles, machinery, and other metal products.

Michigan ranks third among the states in the manufacture of machinery. This includes equipment for metalworking and for refrigeration and various other kinds of industrial equipment. The state also leads in making fabricated metal products. Metal stamping and coating, heating and plumbing equipment, hardware, and cutlery are all included in this industry.

When Michigan was the chief lumbering state, two related industries developed which today are far more





To create the farm lands of the Upper Peninsula, dense forest had to be cut down and swamps drained. Large timberlands still remain. The flat fields above, once the bed of the prehistoric Great Lakes, are now planted to hay, oats, barley, and potatoes. Below is the River Rouge plant of the Ford Motor Company, at Dearborn, which has helped to make Michigan the world's greatest manufacturer of automobiles. The cylindrical building in the foreground, the Rotunda, houses a theater and exhibition hall. Facing it is the Ford Administration Building. (Upper view by Fairchild Aerial Surveys, Inc.)

At the top you see a stock pile of ore on one of the Menominee Range mines that supply Michigan's most valuable mineral, iron. Below this, at the left, lumbermen are cutting timber. Much of the Upper Peninsula is still heavily forested, and millions of cubic feet of timber are cut every year. The children at the right, dressed in costumes for the Holland tulip festival, stand in one of the famous tulip fields that attract thousands of visitors every spring. The bottom scenes show another great natural resource, fisheries. The frozen smelt are fed to mink on fur farms. At the right, fishermen sort their catch.

valuable to the state than lumbering. These are the manufacture of furniture and paper. In both of these industries Michigan ranks sixth among the states. Grand Rapids is one of the most celebrated furniture centers of the world. Furniture fairs held here twice a year attract visitors from all over the United States and abroad (*see* Grand Rapids). Kalamazoo is the chief center of the paper industry.

The breakfast foods and other cereal preparations of Battle Creek are known everywhere. Other important products of the food industry are bakery goods and malt liquors. The manufacture of chemicals centers around Detroit. Here large plants produce industrial chemicals, drugs, medicines, and other products.

A Favorite Vacationland

Michigan is the summer and winter playground for visitors from all over the nation. In 1950, 7 million tourists spent 560 million dollars here. The tourist trade ranks third as a source of income, after manufacturing and agriculture; mining is fourth.

In the rugged and mountainous upper peninsula are wild lake shores and secluded waterfalls, forests abounding with game, and streams well stocked with fish. On Lake Superior, near Grand Marais, are the famous Pictured Rocks—sandstone formations of gray, blue, green, and yellow, cut by wave action into fantastic shapes. Just off the Canadian shore near the northwestern coast of Lake Superior is beautiful Isle Royale. This island, 45 miles long, has been set aside as a national park (*see* National Parks).

Mackinac Island, in the Straits of Mackinac between Lake Michigan and Lake Huron, is a state park. Old Fort Mackinac, begun by the British in 1780, Fort Holmes, which they built during the War of 1812, and old stone blockhouses give the island historic interest. No motor vehicles are permitted to mar the quiet of its 25 miles of carriage drives, saddle paths, and foot trails. Les Chêneaux, often called "the snows," a group of islands east of the straits, are famous for fishing and water sports. Some 300 islands near Michigan's shores lie within its boundaries.

The rivers are mostly short and unimportant except for their scenery. The falls on the Tahquamenon River, near Newberry, are mentioned repeatedly in Longfellow's 'Hiawatha'. The state has more than eleven thousand small lakes, many of them dotted with resorts. Quaint Saugatuck, on Lake Michigan in the south, is a famous artists' colony.

HOW THE LAKES DIVIDE MICHIGAN'S PENINSULAS

The upper peninsula, extending east and west between Lake Superior to the north and Lakes Michigan and Huron to the south, contains most of the state's mines and forests. The lower peninsula, between Lake Michigan on the west and Lakes Huron and Erie on the east, has thriving industries and rich farm lands.

Many cities are noted for their annual celebrations, such as the tulip festival of Holland and the cherry festival at Traverse City. Farther north perch and smelt festivals are held.

The cutting and burning of the virgin forests left large waste areas, unsuitable for agriculture. These lands are being reforested and recreation areas are being developed on them with accommodations for campers, hunters, and fishermen—a project which will be valuable both socially and economically. The state now has more than ten million acres of national and state forests, state parks, game refuges, and public hunting grounds. About one-third of the upper peninsula is national or state forest.

Forests and Forest Life

All Michigan was once a great forest. The southern half of the lower peninsula was a part of the extensive hardwood forest of the Ohio basin. A strip of white pine from 30 to 40 miles wide extended along most of

Lake Michigan. The remainder of the state had a heavy growth of pines and other conifers. The sandy soil and moderate climate, which formerly produced the pines, proved ideal for developing the famous fruit belt. There are still 19 billion board feet of saw timber in spite of heavy demands of numerous wood-products plants and paper mills. Most of this is in the upper peninsula and is chiefly hardwood.

Black bear, moose, deer, lynx, wolf, coyote, porcupine, and game birds still lure hunters. The game and bird sanctuary of Isle Royale attracts many nature lovers. In the remarkable dunes region along the southeastern shore of Lake Michigan, plants and trees that seldom grow so far north thrive in profusion.

The upper peninsula and the northern part of the lower peninsula are believed to have been a part of the great Laurentian highland, one of the oldest and most interesting areas on earth to the geologist. It is about the age of the Scottish Highlands and the mountains of Norway (*see* Laurentian Plateau).

Glaciation and weathering by winds and waters have covered most of the state with a great variety of soils and topography. These and a wide range of temperature, since the state extends through nearly six degrees of latitude, have produced a remarkable diversity of vegetation and agriculture.

Travel in the Two Peninsulas

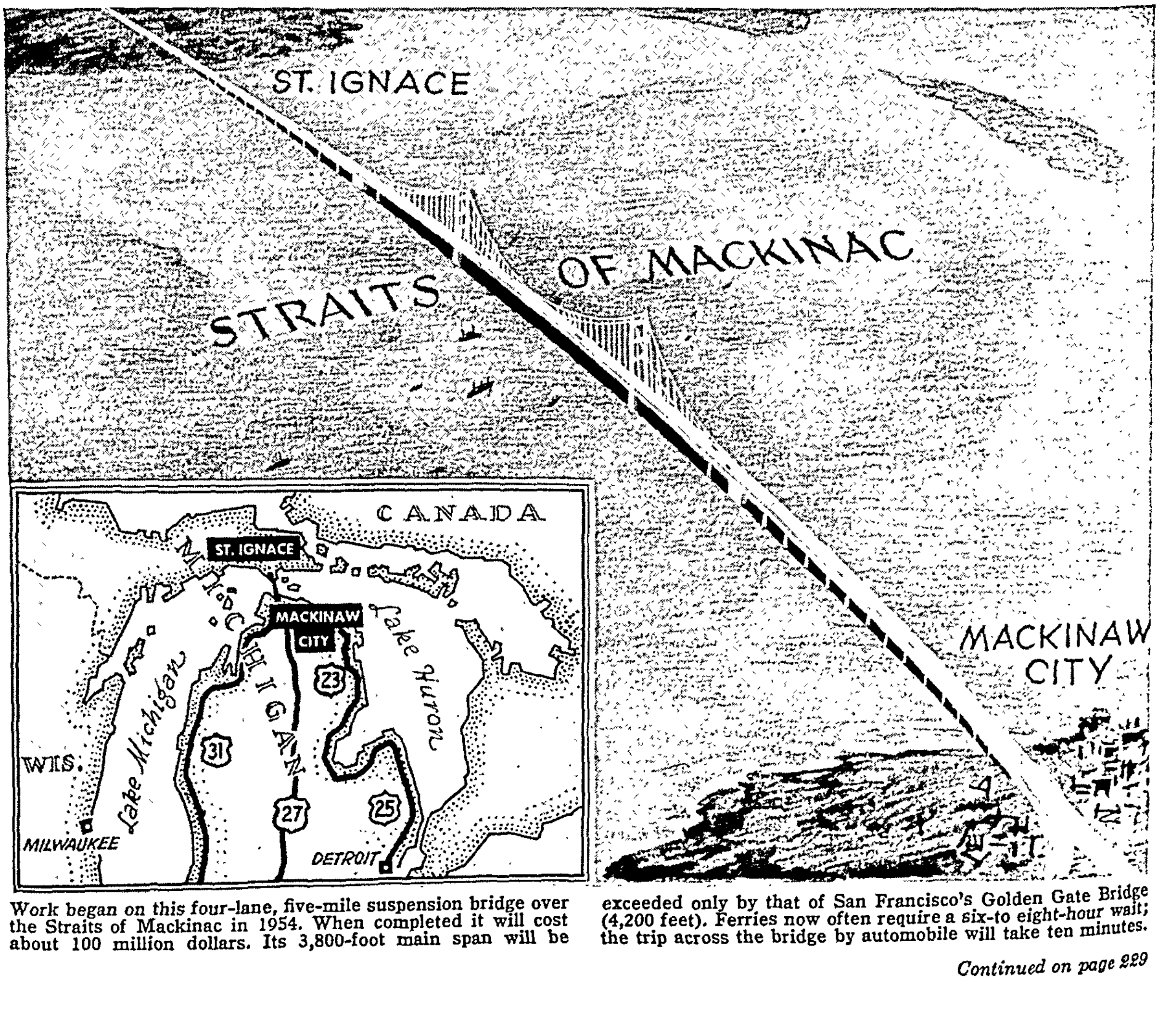
Michigan has a fine natural and man-made transportation system. Along the Great Lakes are excellent harbors. The Detroit River and the Soo Canal carry millions of tons of freight annually (*see* Sault Sainte Marie). Ferries carry traffic across Lake Michigan to and from Wisconsin. The St. Lawrence Seaway Project, approved by Congress in 1954, promises to make Detroit and the other lake cities into ocean ports. Highways, railways, and airways crisscross the state. Construction began in 1954 on the long-talked-of highway bridge over the Straits of Mackinac.

A Rich Hunting Ground for Indians

Before the coming of white men, Michigan was a rich hunting ground for Indians, principally the Ojibwa (also called Chippewa) and the Potawatomi tribes. Some of them paddled down the St. Lawrence to Quebec with great bundles of fur. There the *coureurs de bois,* or French fur traders, heard of the beautiful lake country and visited it in search of pelts.

Then came a group of famous explorers and missionaries. Jean Nicolet was the first white man to

A GREAT BRIDGE TO LINK UPPER AND LOWER MICHIGAN



Work began on this four-lane, five-mile suspension bridge over the Straits of Mackinac in 1954. When completed it will cost about 100 million dollars. Its 3,800-foot main span will be exceeded only by that of San Francisco's Golden Gate Bridge (4,200 feet). Ferries now often require a six-to eight-hour wait; the trip across the bridge by automobile will take ten minutes.

Continued on page 229

Michigan Fact Summary

MICHIGAN (Mich.): Probably from an Algonquian Indian word *Michigamea,* meaning "great lake." Named for position on Lake Michigan.

Nickname: "Wolverine State"—origin unknown; perhaps from wolverines that supposedly once prowled Michigan forests.

Seal: Moose and elk support shield; on it man stands at tip of a peninsula. Atop shield is the word Tuebor (I Will Defend). State motto is on scroll beneath.

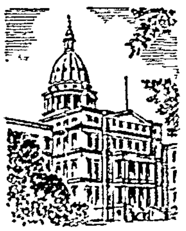
Motto: Si Quaeris Peninsulam Amoenam Circumspice (If You Seek a Beautiful Peninsula, Look about You).

Flag: For description and illustration, *see* Flags.

Flower: Apple blossom. **Bird:** Robin. **Tree:** None official.

Song (unofficial): 'Michigan, My Michigan'—words, Douglas M. Malloch; music, W. Otto Miessner.

THE GOVERNMENT



Capital: Lansing (since 1847).

Representation in Congress: Senate, 2; House of Representatives, 18. Electoral votes, 20.

State Legislature: Senators, 34; term, 2 years. Representatives, 110; term, 2 years. Convenes 2d Wed. in January. No limit to length of session.

Constitution: Adopted 1909. Proposed amendment must be (a) passed by a two-thirds majority in each house of the legislature or by initiative action of the people and (b) ratified by a majority voting on amendment.

Governor: Term, 2 years. May succeed himself.

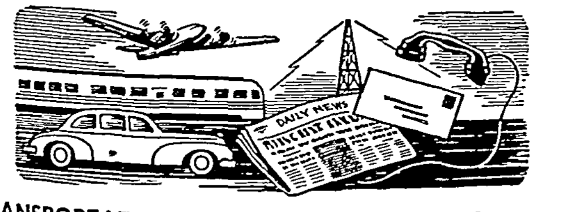
Other Executive Officers: Lieutenant governor, secretary of state, attorney general, treasurer, auditor general, supt. of public instruction, all elected; terms, 2 years; highway commissioner, elected; term, 4 years.

Judiciary: Supreme court—8 justices, elected at large; term, 8 years. Circuit courts—40; judges elected; term, 6 years. Probate courts—1 in each county; judges elected; term, 4 years.

County: 83 counties, each governed by a board of supervisors of varying numbers; boards and county officers elected; terms, 2 years.

Municipal: Mayor-council most common; also commission-city-manager and aldermanic forms.

Voting Qualifications: Age, 21; residence in state, 6 months; in district, 30 days.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 6,800 miles. First railroad, Erie and Kalamazoo (Adrian to Toledo), 1836. Rural roads, 92,800 miles. Airports, 249.

Communication: Periodicals, 153. Newspapers, 415. First newspaper, *Michigan Essay,* Detroit (one issue), 1809; *Detroit Gazette,* Detroit, 1817. Radio stations (AM and FM), 87; first station, WWJ, Detroit, licensed Oct. 13, 1921 (licensed as experimental station 8MK, Aug. 20, 1920). Television stations, 13; first station, WWJ-TV, Detroit, began operation June 3, 1947. Telephones, 2,376,000. Post offices, 1,008.

THE PEOPLE AND THEIR LAND

Population (1950 census): 6,371,766 (rank among 48 states—7th); urban, 70.7%; rural, 29.3%; Density: 111.7 persons per square mile (rank—11th state).

Extent: Area, 58,216 square miles, including 1,194 square miles of water surface (22d state in size; 10th if Great Lakes area of 38,575 square miles is added).

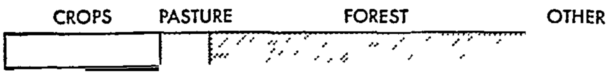
Elevation: Highest, in Porcupine Mountains, near Ontonagon, 2,023 feet; lowest, Lake Erie, 572 feet.

Temperature (°F.): Average—annual, 45°; winter, 22°; spring, 42°; summer, 67°; fall, 48°. Lowest recorded, −51° (Vanderbilt, Feb. 9, 1934); highest recorded, 112° (Mio, July 13, 1936).

Precipitation: Average (inches)—annual, 31; winter, 5; spring, 8; summer, 9; fall, 9. Varies from about 26 inches in the central section to about 36 inches in the south central.

Natural Features: Two peninsulas, divided by Lake Michigan and Straits of Mackinac. The lower (southern) peninsula is a tableland in the north with low, level, or slightly rolling country in the south; the upper (northern) peninsula is low and somewhat swampy in the eastern portion, but broken and rugged in the west. The Porcupine Mountains in the northwest lie along Lake Superior. Many small rivers and lakes.

Land Use: Cropland, 25%; nonforested pasture, 8%; forest, 51%; other (roads, parks, game refuges, wasteland, cities, etc.), 16%.



Natural Resources: *Agricultural*—good soil, ample growing season, adequate precipitation. *Industrial*—forests; iron ore, petroleum, cement, salt, sand and gravel, stone; fish. *Commercial*—position on Great Lakes; climate and scenery attract vacationists.

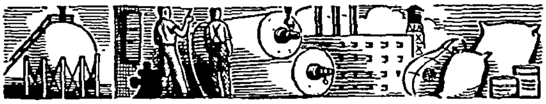
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Manufacturing	978,312	41.0
Wholesale and retail trade	421,247	17.6
Professional services (medical, legal, educational, etc.)	187,502	7.8
Agriculture, forestry, and fishery	162,031	6.8
Transportation, communication, and other public utilities	151,063	6.3
Construction	118,418	4.9
Personal services (hotel, domestic, laundering, etc.)	112,580	4.7
Government	73,802	3.1
Finance, insurance, and real estate	64,436	2.7
Business and repair services	55,377	2.3
Amusement, recreation, and related services	21,589	0.9
Mining	15,543	0.6
Workers not accounted for	31,674	1.3
Total employed	2,393,574	100.0

Michigan Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—5th)
Value added by manufacture* (1952), $8,284,675,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
TRANSPORTATION EQUIPMENT.... Motor vehicles and equipment	$1,938,214,000	1
MACHINERY (EXCEPT ELECTRICAL) Metal working machinery; refrigeration machinery	796,178,000	3
FABRICATED METAL PRODUCTS... Metal stamping and coating; cutlery, hand tools, and hardware	496,091,000	4
PRIMARY METAL INDUSTRIES.... Gray-iron foundries; steel works and rolling mills	427,239,000	5
FOOD AND KINDRED PRODUCTS... Bakery products; cereal preparations; malt liquors	284,824,000	12
CHEMICALS AND ALLIED PRODUCTS	281,118,000	6

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—15th)
Total cash income (1952), $735,869,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Milk............	2,518,000,000 qts.	1	7
Corn............	59,089,000 bu.	2	14
Cattle..........	403,496,000 lbs.	3	17
Hay............	3,768,000 tons	4	9
Hogs............	314,566,000 lbs.	5	15
Eggs............	126,000,000 doz.	6	14
Wheat..........	23,553,000 bu.	7	14

*Rank in dollar value †Rank in units produced

C. Fish (Rank among states—17th)
(Great Lakes, 1950), 23,153,000 lbs.; value, $3,497,000

D. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $257,939,000
Rank among states—12th

Minerals (1951)	Amount Produced	Value
Iron ore.............	13,612,000 tons	$81,766,000
Petroleum............	13,927,000 bbls.	37,880,000
Cement..............	14,113,000 bbls.	35,121,000
Salt................	5,138,000 tons	21,221,000
Sand and gravel......	27,541,000 tons	20,977,000

E. Lumber (Rank among states—18th)
496,000,000 board feet (5-year average)

F. Trade

Trade (1948)	Sales	Rank among States
Wholesale.........	$6,[illegible]20,751,000	8
Retail............	5,9[illegible]0,278,000	7
Service...........	53[illegible],343,000	7

EDUCATION

Public Schools: Elementary, 5,780; secondary, 764. Compulsory school age, 6 through 15. State Board of Education, 3 members, elected, 6-year terms; supt. of public instruction, who serves ex officio, elected, 2-year term. District school boards, elected, 3- to 5-year terms. County boards appoint county school supts., up to 4-year terms. City boards of education, 7 to 9 members, elected, 3- to 6-year terms; appoint city district supts., up to 5-year terms.

Private and Parochial Schools: 618.

Colleges and Universities (accredited): Colleges, 48; junior colleges, 14. State-supported schools include the Univ. of Mich., Ann Arbor; Mich. State College, East Lansing; Mich. College of Mining and Technology, Houghton; Ferris Institute, Big Rapids; four normal colleges—Mich. State Normal College, Ypsilanti; Central Mich. College of Education, Mt. Pleasant; Western Mich. College of Education, Kalamazoo; Northern Mich. College of Education, Marquette.

Special State Institutions: Michigan School for the Deaf, Flint; Michigan School for the Blind, Lansing.

Libraries: City, village, township public libraries, 287; independent county libraries, 25. State library aids in developing public and school library service; work headed by state librarian; staff includes school and public library consultants. Noted special libraries: Wm. L. Clements Library, Univ. of Mich., Ann Arbor; Burton Historical Library, Detroit Public Library, Detroit.

Outstanding Museums: University Museums, U. of Michigan, Ann Arbor; Cranbrook Academy of Art, Cranbrook Institute of Science, both in Bloomfield Hills; Edison Institute, Dearborn; Institute of Arts, Detroit.

SOCIAL WELFARE INSTITUTIONS

Boys' Vocational School, Lansing; Girls' Training School, Adrian; Mich. Children's Inst., Ann Arbor; Mich. Employment Institution for the Blind, Saginaw.

CORRECTIONAL AND PENAL INSTITUTIONS

State Prison of Southern Mich., Jackson; State House of Correction and Branch Prison, Marquette; Mich. State Reformatory, Ionia; Cassidy Lake Tech. School, Chelsea; Detroit House of Correction, Plymouth.

STATE FORESTS*†

Au Sable—290,090 acres (23); Escanaba River—199,581 acres (15); Fife Lake—187,181 acres (29); Grand Sable—202,145 acres (8); Hardwood—186,168 acres between state park symbols (21) and (22); Houghton Lake—321,426 acres (25); Lake Superior—226,859 acres (9); Mackinac—311,355 acres (17); Sturgeon River—282,761 acres (14); Thunder Bay River—188,656 acres n.e. of (23).

NATIONAL FORESTS*

Hiawatha—822,013 acres; hdqrs., Escanaba (19).
Huron—762,311 acres; hdqrs., Cadillac (27).
Manistee—1,254,855 acres; hdqrs., Cadillac (34).
Marquette—503,417 acres; hdqrs., Escanaba (18).
Ottawa—1,742,966 acres; hdqrs., Ironwood (6).

NATIONAL PARK*

Isle Royale—133,839 acres; cliff-bound, forested island in n.w. Lake Superior; lava peaks, sea-carved terraces and rock pillars; ancient copper mines; moose herd (2).

*Numbers in parentheses are keyed to map.
†There are 22 state forests in Michigan; the 10 largest are listed.

Michigan Fact Summary

STATE PARKS*†

Burt Lake—fishing, beaches, wooded hills and bluffs (22).
Fort Wilkins—fort built about 1844 to protect Keweenaw Peninsula copper mines, museum (1).
Gogebic Lake—Largest lake in upper peninsula; beaches; hardwood forest (5).
Harrisville—beach, campgrounds on Lake Huron (28).
Hartwick Pines—virgin forest; lumberman's museum (26).
Higgins Lake—clear lake in well-wooded park (30).
Interlochen—near National High School Orchestra Camp; stand of virgin red pine; beach (24).
Ludington—sand beach; scenic dunes; ghost town of Hamlin, once a lumber center (32).
Mackinac Island—in Straits of Mackinac; historic Fort Mackinac, Arch Rock, Astor House; views of straits and Great Lakes shipping (21).
Muskegon—wooded area; shifting sand dunes (35).
Palms Book—Kitchitikipi, a giant emerald-colored spring with bubbling sand bottom, woods (20).
Porcupine Mountains—on Lake Superior; Lake of the Clouds, Mirror Lake in rocky, forested region; highest point in state, 2,023 feet (3).
Tahquamenon Falls—upper and lower falls of Tahquamenon River in a vast wilderness (12).
Walter J. Hayes—includes part of Irish Hills, named from their resemblance to Irish countryside (40).

PLACES OF INTEREST*

Ann Arbor—seat of U. of Michigan; Nichols Arboretum famous for lilacs and peonies (41).
Benton Harbor—resort with mineral springs; House of David; open-air Municipal Fruit Market (43).
Chamberlain Memorial Museum—Three Oaks; contains thousands of Indian and pioneer relics (45).
Dearborn—Edison Institute; restored historical buildings in Greenfield Village (*see* Dearborn) (42).
Detroit—Ambassador Bridge; Children's Museum; Belle Isle Park; Zoological Park (*see* Detroit) (38).
Grand Rapids—Furniture Museum, period and modern furniture, (*see* Grand Rapids) (37).
Holland—tulip center of America; Netherlands Museum contains Dutch historical exhibits (36).
Ironwood—in Gogebic iron range; deep iron mines (4).
Kellogg Bird Sanctuary—near Battle Creek (39).
Lac Vieux Desert—Indian burial grounds (10).
Lansing—State Capitol (*see* Lansing); northeast of (39).
Lumbermen's Memorial—statue near Oscoda (31).
Pictured Rocks—rocks of varied form and color near Munising, told of in Longfellow's 'Hiawatha' (11).
Presque Isle—Marquette; great natural park (7).
Sault Ste. Marie—state's oldest settlement; "Soo" canal locks, world's busiest (*see* Sault Sainte Marie) (13).
Sleeping Bear Dune—large 600-foot-high sand dune moves 6 feet a year, near Glen Haven, northwest of (24).
Walker Tavern—stagecoach tavern erected in 1832 near Cambridge Junction, has original furnishings (44).

*Numbers in parentheses are keyed to map
†There are 54 state parks in Michigan; 14 are listed. In addition there are 13 state recreation areas and 2 state historic sites

LARGEST CITIES (1950 census)

Detroit (1,849,568): automobile capital of the world; Great Lakes port on Detroit River, huge steelworks and rolling mills, many other large industries
Grand Rapids (176,515): furniture capital of the U.S.; western Michigan trade center; metal, wood products.
Flint (163,143): center of large automobile industry.
Dearborn (94,994): automobile, steel and metal products.
Saginaw (92,918): automotive parts, steel products
Lansing (92,129): state capital, automobiles and parts.
Pontiac (73,681) automobiles and parts, trucks, paints.
Kalamazoo (57,704): paper, pharmaceuticals, furnaces.

Michigan Fact Summary

THE PEOPLE BUILD THEIR STATE

1622—Étienne Brulé, a Frenchman, believed to have visited the Sault (rapids) of St. Marys River.

1634—Jean Nicolet, sent from Quebec by Samuel de Champlain, explores Great Lakes; in search of passage to the Orient and to open trade with Indians, he travels by canoe through Georgian Bay, Straits of Mackinac, and Lake Michigan.

1668—Father Marquette opens mission at Sault Ste. Marie; first permanent white settlement in what is now Michigan grows up around the mission.

1671—Marquette establishes Mission of Michilimackinac at St. Ignace. At Sault Ste. Marie, Simon Daumont, Sieur de St. Lusson takes possession of Great Lakes region for France.

1679—René Robert Cavelier, Sieur de La Salle builds Fort Miami at mouth of St. Joseph River.

1690—Father Aveneau sets up mission at site of Niles; Fort St. Joseph built there, 1697.

1701—Antoine de la Mothe Cadillac founds Detroit.

1711—Cadillac removed; his departure leads to decline of Detroit and increased Indian attacks on settlers.

1729—Robert Navarre establishes first civil jurisdiction in area, improving settlement conditions.

1754—French and Indian War begins; many settlers join French forces.

1760—French surrender to British at Montreal gives Michigan area to British; British troops occupy Detroit, November 29.

1763—Treaty of Paris confirms French cession to Britain of Great Lakes region, including present Michigan. Indians attack British forts; Pontiac lays siege to Detroit; Indians defeated, 1764.

1775—First British civil governor, Henry Hamilton, arrives at Detroit. Michigan remains loyal to Britain through Revolution despite considerable unrest and increased Indian attacks.

1783—Under Treaty of Paris, Britain grants Michigan to U. S. with border through middle of Great Lakes; British keep force in Michigan region until 1796.

1786—All eastern seaboard regions surrender western lands (including Michigan) to U. S.

1787—Congress organizes Northwest Territory; includes Michigan.

1791—Michigan annexed to Upper Canada by British; elects delegates to Parliament, 1792 and 1794, in first elections in region.

1794—Gen. Anthony Wayne defeats Indians at battle of Fallen Timbers in Ohio; in 1795 Indians cede to U. S. most of Northwest Territory.

1796—British surrender Detroit, July 11, to General Wayne's forces; Wayne County created to include most of present Michigan.

1800—Eastern Michigan included in Ohio Territory; much of western part in Indiana Territory.

1805—Michigan organized as separate territory; governor, Gen. William Hull; capital, Detroit. Detroit burns, June 11; new town laid out, 1806, according to detailed plans designed by Augustus Woodward.

1806—Bank of Detroit, first in territory, incorporated; fails, 1808; Bank of Michigan organized, 1817.

1807—Indians cede southeastern Michigan to U. S.

1808—Father Gabriel Richard with help of legislature begins system of schools for Indian and white children; brings printing press to Detroit, 1809.

1812—Detroit surrenders to British August 17 in War of 1812; Chippewa Indians join British in fighting U.S.

1813—Detroit retaken by U. S. after British defeat on Great Lakes.

1817—University of Michigan chartered at Detroit; opens at Ann Arbor, 1841.

1818—First steamboat on Great Lakes, the *Walk-in-the-Water*, begins trips between Buffalo and Detroit. First public land sales held at Detroit greatly encourage settlement of territory.

1819—In Treaty of Saginaw, Chippewa Indians cede to U. S. large area in central Michigan.

1821—In Treaty of Chicago, Indians cede to U. S. southwestern part of Michigan.

1822—Henry Rowe Schoolcraft appointed Indian agent at Sault Ste. Marie; he begins his important ethnological studies of the Indians.

1825—Military road from Detroit to Chicago begun. Opening of Erie Canal speeds settlement of area.

1834—Michigan settlers petition Congress for statehood. Ohio claims Toledo area; Congress refuses petition.

1835—Oil discovered in Macomb County. Congress awards Ohio the Toledo area, giving Michigan the Upper Peninsula, 1836.

1837—Michigan admitted to the Union, Jan. 26; capital, Detroit; governor, Stevens T. Mason. Public school system plan of John D. Pierce adopted; considered to be first modern state school system in U. S. Detroit and St. Joseph, Mich., linked by rail.

1844—Iron ore discovered at site of present Negaunee.

1845—Cliff Lode (copper) opened in Keweenaw District.

1847—State capital moved to Lansing. Minnesota copper mine opened at Rockland.

1848—First iron smelter in the state opened near Marquette. Legislature meets first time in Lansing.

1850—New state constitution framed.

1854—Most Indians in state settled on Upper Peninsula Reservation; granted more land on Isabella Reservation in 1855 and 1864. Political convention at Jackson adopts party name of "Republican."

1855—State completes "Soo" ship canal and locks.

1857—Michigan Agricultural College, first of its kind in U. S., opened in East Lansing.

1860—First salt successfully well-drilled in Saginaw County, leading to valuable salt production.

1864—Copper lode found at Calumet.

1874—State supreme court in famous decision in the Kalamazoo Case establishes right of state to levy taxes for higher as well as elementary education.

1881—Hydroelectric plant built at Grand Rapids. Railroad ferry links Upper and Lower Peninsulas.

1903—Organization of Ford Motor Company in Detroit begins Michigan's lead in automobile industry.

1909—Present state constitution becomes effective.

1910—Railway tunnel opened between Detroit and Windsor, Ontario. Vehicular tunnel opened 1930, is first tunnel of its kind between two countries.

1950—Voters approve state constitutional amendment outlawing advocacy of overthrow of government.

1951—Detroit celebrates 250th anniversary of its settlement; has long transit strike, April 21–June 18.

1952—In overcrowded Southern Michigan State Prison, world's largest walled prison, 2,600 convicts riot.

1953—Tornadoes hit Michigan, particularly Flint; also strike at Port Huron, Ann Arbor, and Erie; more than 100 killed, hundreds injured. Fire destroys huge General Motors plant at Livonia.

1954—Construction begins on Straits of Mackinac Bridge

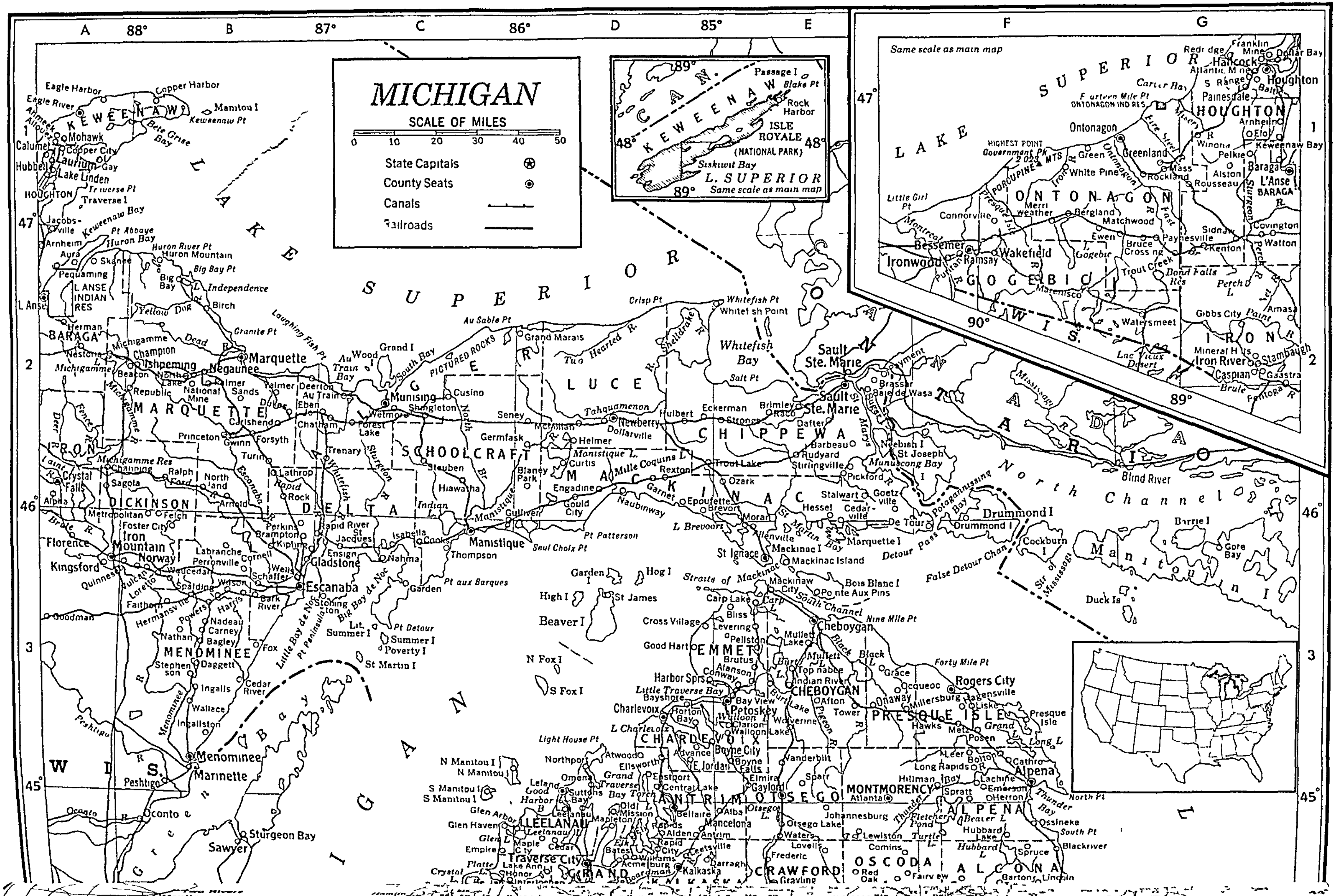
MICHIGAN

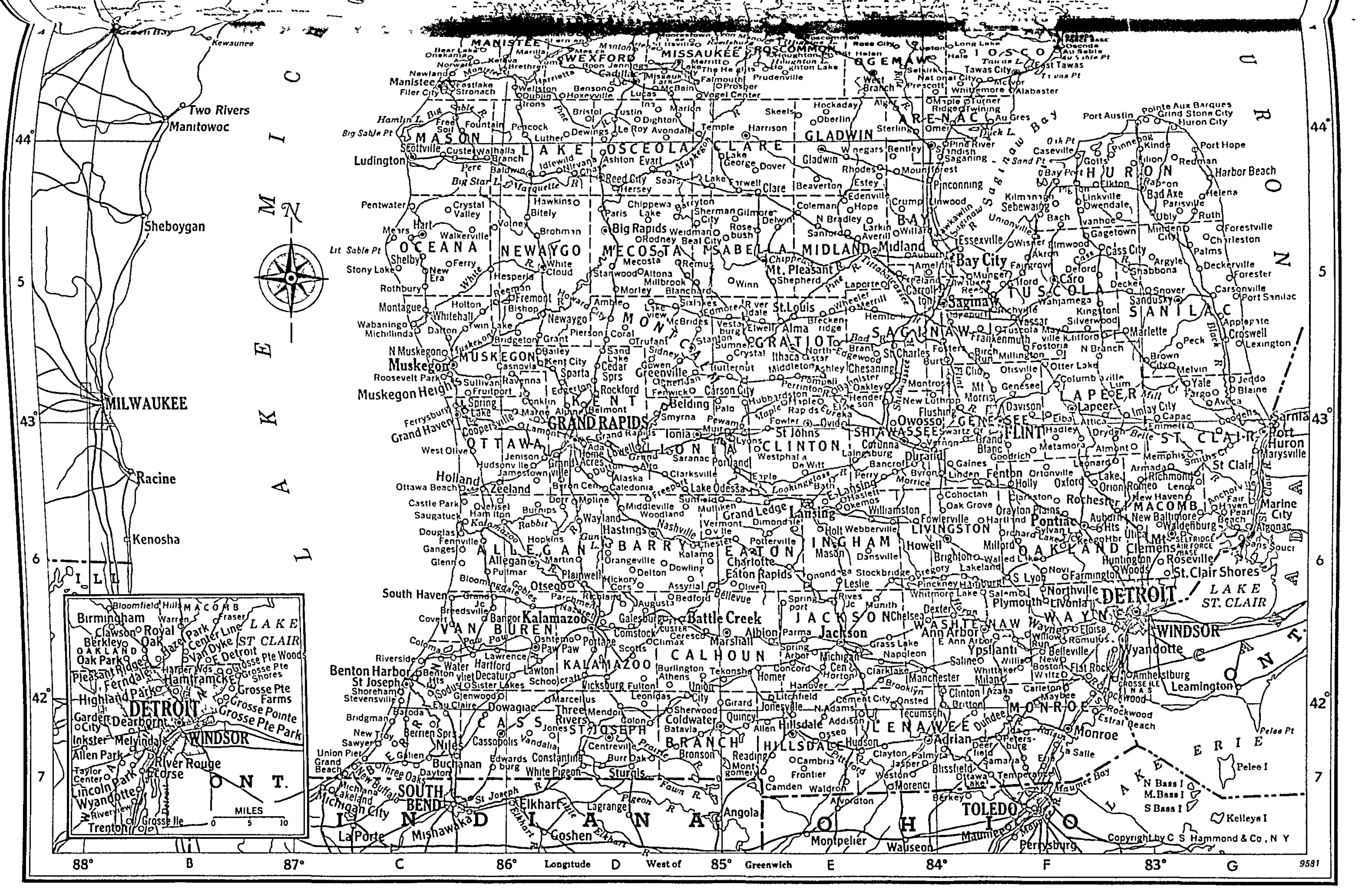
COUNTIES

Alcona	5,856	F 4
Alger	10,007	C 2
Allegan	47,493	D 6
Alpena	22,189	F 4
Antrim	10,721	D 3
Arenac	9,644	F 4
Baraga	8,037	A 2
Barry	26,183	D 6
Bay	88,461	E 5
Benzie	8,306	C 4
Berrien	115,702	C 7
Branch	30,202	D 7
Calhoun	120,813	D 6
Cass	28,185	C 7
Charlevoix	13,475	D 3
Cheboygan	13,731	E 3
Chippewa	29,206	E 2
Clare	10,253	E 5
Clinton	31,195	E 6
Crawford	4,151	E 4
Delta	32,913	C 2
Dickinson	24,844	B 2
Eaton	40,023	E 6
Emmet	16,534	E 3
Genesee	270,963	F 5
Gladwin	9,451	E 4
Gogebic	27,053	F 2
Grand Traverse	28,598	D 4
Gratiot	33,429	E 5
Hillsdale	31,916	E 7
Houghton	39,771	G 1
Huron	33,149	F 5
Ingham	172,941	E 6
Ionia	38,158	D 6
Iosco	10,906	F 4
Iron	17,692	G 2
Isabella	28,964	E 5
Jackson	107,925	E 6
Kalamazoo	126,707	D 6
Kalkaska	4,597	D 4
Kent	288,292	D 5
Keweenaw	2,918	A 1
Lake	5,257	D 5
Lapeer	35,794	F 5
Leelanau	8,647	D 4
Lenawee	64,629	E 7
Livingston	26,725	F 6
Luce	8,147	D 2
Mackinac	9,287	D 2
Macomb	184,961	G 6
Manistee	18,524	C 4
Marquette	47,654	B 2
Mason	20,474	C 4
Mecosta	18,968	D 5
Menominee	25,299	B 3
Midland	35,662	E 5
Missaukee	7,458	D 4
Monroe	75,666	F 7
Montcalm	31,013	D 5
Montmorency	4,125	E 3
Muskegon	121,545	C 5
Newaygo	21,567	D 5
Oakland	396,001	F 6
Oceana	16,105	C 5
Ogemaw	9,345	E 4
Ontonagon	10,282	F 1
Osceola	13,797	D 5
Oscoda	3,134	E 4
Otsego	6,435	E 3
Ottawa	73,751	C 6
Presque Isle	11,996	F 3
Roscommon	5,916	E 4
Saginaw	153,515	E 5
Saint Clair	91,599	G 6
Saint Joseph	35,071	D 7
Sanilac	30,837	G 5
Schoolcraft	9,148	C 2
Shiawassee	45,967	E 6
Tuscola	38,258	F 5
Van Buren	39,184	C 6
Washtenaw	134,606	F 6
Wayne	2,435,235	F 6
Wexford	18,628	D 4

CITIES AND TOWNS

Acme	300	D 4
Ada	500	D 6
Addison	488	E 7
Adrian	18,393	F 7
Advance	50	D 3
Afton	450	E 3
Ahmeek	360	A 1
Akron	431	F 5
Alabaster	125	F 4
Alanson	319	E 3
Alaska	335	D 6
Alba	500	E 4
Albion	10,406	E 6
Alden	350	D 4
Alger	445	E 4
Algonac	2,639	G 6
Allegan	4,801	D 6
Allen	340	E 7
Allen Park	12,329	B 7
Allenville	200	E 3
Allouez	310	A 1
Alma	8,341	E 5
Almont	1,035	F 6
Alpena	13,135	F 3
Alpha	378	A 2
Alpine	100	D 5
Alston	150	G 1
Alto	400	D 6
Altona	85	D 5
Amasa	700	G 2
Amble	51	D 5
Amelith	150	F 5
Anchorville	950	G 6
Ann Arbor	48,251	F 6
Antrim	300	D 4
Applegate	244	G 5
Arcadia	450	C 4
Argyle	400	G 5
Arlene	86	D 4
Armada	961	G 6
Arnheim	50	G 1
Arnold	130	B 2
Ashley	449	E 5
Ashton	178	D 5
Assyria	200	D 6
Athens	768	D 6
Atlanta	350	E 3
Atlantic Mine	800	G 1
Attica	320	F 5
Atwood	60	D 3
Au Gres	442	F 4
Au Sable	300	F 4
Au Train	106	C 2
Auburn	869	F 5
Auburn Heights	2,500	F 6
Augusta	898	D 6
Aura	295	A 2
Averill	100	E 5
Avoca	300	G 5
Avondale	50	D 4
Azalia	110	F 6
Bach	125	F 5
Bad Axe	2,973	G 5
Bagley	60	B 3
Baie de Wasai	100	E 2
Bailey	300	D 5
Baldwin	835	D 5
Baltic	500	G 1
Bancroft	615	E 6
Bangor	1,694	C 6
Bannister	300	E 5
Baraga	942	G 1
Barbeau	50	E 2
Bark River	500	B 3
Baroda	344	C 7
Barryton	445	D 5
Barton City	100	F 4
Batavia	124	D 7
Bates	75	D 4
Bath	600	E 6
Battle Creek	48,666	D 6
Bay City	52,523	F 5
Bay Port	557	F 5
Bay View	25	E 3
Bayshore	200	D 3
Beacon	300	B 2
Beal City	338	D 5
Bear Lake	364	C 4
Beaverton	794	E 5
Bedford		D 6
Belding	4,436	D 5
Bellaire	693	D 4
Belleville	1,722	F 6
Bellevue	1,168	E 6
Belmont	200	D 5
Bendon	79	D 4
Benson	22	D 4
Bentley	150	E 5
Benton Harbor	18,769	C 6
Benton Heights	6,160	C 6
Benzonia	407	D 4
Bergland	800	F 1
Berkley	17,931	B 6
Berrien Springs	1,761	C 7
Bessemer	3,509	F 2
Beulah	458	C 4
Big Bay	670	B 2
Big Rapids	6,736	D 5
Birch	8	B 2
Birch Run	800	F 5
Birmingham	15,467	B 6
Bishop	100	D 5
Bitely	200	D 5
Blackriver	259	F 4
Blaine	108	G 5
Blanchard	300	D 5
Blaney Park	30	D 2
Bliss	75	E 3
Blissfield	2,365	F 7
Bloomfield Hills	1,468	B 6
Bloomingdale	465	C 6
Bolton	25	F 3
Boon	260	D 4
Boyne City	3,028	E 3
Boyne Falls	236	E 3
Brampton	300	B 3
Branch	150	D 5
Brant	95	E 5
Brassar	75	E 2
Breckenridge	985	E 5
Breedsville	239	C 6
Brethren	500	D 4
Brevort	80	E 2
Bridgeport	1,200	F 5
Bridgeton	100	D 5
Bridgman	977	C 7
Brighton	1,861	F 6
Brimley	500	E 2
Bristol	40	D 4
Britton	517	F 6
Brohman	150	D 5
Bronson	2,106	D 7
Brooklyn	862	E 6
Brown City	878	G 5
Bruce Crossing	200	G 2
Brutus	200	E 3
Buchanan	5,224	C 7
Buckley	194	D 4
Burlington	329	D 6
Burnips	170	D 6
Burr Oak	814	D 7
Burt	200	F 5
Burt Lake	60	E 3
Butternut	128	E 5
Byron	439	E 6
Byron Center	650	D 6
Cadillac	10,425	D 4
Caledonia	619	D 6
Calumet	1,256	A 1
Cambria	210	E 7
Camden	380	E 7
Capac	1,104	G 5
Carleton	1,039	F 6
Carlshend	100	B 2
Carney	325	B 3
Caro	3,464	F 5
Carp Lake	200	E 3
Carrollton	2,000	E 5
Carson City	1,168	E 5
Carsonville	487	G 5
Caseville	482	F 5
Casnovia	312	D 5
Caspian	1,608	G 2
Cass City	1,762	F 5
Cassopolis	1,527	C 7
Castle Park	9	C 6
Cathro	100	F 3
Cedar	249	D 4
Cedar River	75	B 3
Cedar Springs	1,378	D 5
Cedarville	250	E 2
Cement City	500	E 6
Center Line	7,659	B 6
Central Lake	692	D 3
Centreville	879	D 7
Ceresco		D 6
Champion	567	B 2
Channing	497	B 2
Charleston	85	G 5
Charlevoix	2,695	D 3
Charlotte	6,606	E 6
Chase	300	D 5
Chatham	650	B 2
Cheboygan	5,687	E 3
Chelsea	2,580	E 6
Chesaning	2,264	E 5
Chester	50	D 6
Chippewa Lake	125	D 5
Clare	2,440	E 5
Clarion	84	E 3
Clarklake	500	E 6
Clarkston	722	F 6
Clarksville	339	D 6
Clawson	5,196	B 6
Clayton	467	E 7
Clifford	330	F 5
Climax	524	D 6
Clinton	1,344	F 6
Clio	1,963	F 5
Cohoctah	150	F 6
Coldwater	8,594	D 7
Coleman	1,024	E 5
Coloma	1,041	C 6
Colon	1,000	D 7
Columbiaville	789	F 5
Comins	87	E 4
Comstock	8,314	D 6
Concord	730	E 6
Conklin	350	D 5
Connorville	50	F 1
Constantine	1,514	D 7
Conway	100	E 3
Cooks	300	C 3
Coopersville	1,371	C 5
Copemish	255	D 4
Copper City	336	A 1
Copper Harbor	30	B 1
Coral	300	D 5
Cornell	20	B 3
Corunna	2,358	E 6
Covert	450	C 6
Covington	260	G 2
Cross Village	200	D 3
Croswell	1,775	G 5
Crump	75	E 5
Crystal	450	E 5
Crystal Falls	2,316	A 2
Crystal Valley	250	C 5
Curran	50	F 4
Curtis	300	D 2
Curtisville	25	F 4
Cusino	50	C 2
Custer	260	C 5
Dafter	125	E 2
Daggett	341	B 3
Dalton	500	C 5
Dansville	433	E 6
Darragh	20	E 4
Davison	1,745	F 5
Dayton	125	C 7
De Tour	611	F 3
De Witt	824	E 6
Dearborn	94,994	B 7
Decatur	1,664	C 6
Decker	100	F 5
Deckerville	719	G 5
Deerfield	725	F 7
Deerton	225	B 2
Deford	200	F 5
Delton	700	D 6
Delwin	100	E 5
Detroit	1,849,568	B 7
Dewings	6	D 4
Dexter	1,307	F 6
Dighton	100	D 4
Dimondale	774	E 6
Dollar Bay	600	G 1
Dollarville	100	D 2
Dorr	428	D 6
Douglas	447	C 6
Dover	20	E 5
Dowagiac	6,542	D 6
Dowling	126	D 6
Drayton Plains	3,500	F 6
Drummond I.	443	F 3
Dryden	476	F 6
Dublin	25	D 4
Dukes	150	B 2
Dundee	1,975	F 7
Durand	3,194	E 6
Dutton	150	D 6
Eagle	145	E 6
Eagle Harbor	75	A 1
Eagle River	65	A 1
East Ann Arbor	1,826	F 6
East Detroit	21,461	B 6
East Grand Rapids	6,403	D 6
East Jordan	1,779	D 3
East Lansing	20,325	E 6
East Tawas	2,040	F 4
Eastlake	376	C 4
Eastport	125	D 3
Eaton Rapids	3,509	E 6
Eau Claire	480	C 6
Eben Junction	400	B 2
Eckerman	300	E 2
Ecorse	17,948	B 7
Edenville	140	E 5
Edgerton	200	D 5
Edgewood	50	E 5
Edmore	971	E 5
Edwardsburg	616	C 7
Elba		F 5
Elberta	597	C 4
Eldorado	31	E 4
Elk Rapids	889	D 4
Elkton	854	F 5
Ellsworth	369	D 3
Elmira	230	E 3
Elmwood	100	F 5
Elo	35	G 1
Eloise	5,000	F 6
Elsie	911	E 5
Elwell	150	E 5
Emerson	40	F 3
Emmett	230	G 6
Empire	251	C 4
Engadine	500	D 2
Ensign	446	C 3
Epoufette	50	D 2
Erie	800	F 7
Escanaba	15,170	C 3
Essexville	3,167	F 5
Estey	50	E 5
Estral Beach	188	F 7
Eureka		E 5
Evart	1,578	D 5
Ewen	817	F 2
Fair Haven	1,200	G 6
Fairgrove	570	F 5
Fairview	300	F 4
Faithorn	233	B 3
Falmouth	300	E 4
Fargo	110	G 5
Farmington	2,325	F 6
Farwell	694	E 5
Felch	200	B 3
Fennville	639	C 6
Fenton	4,226	F 6
Fenwick	150	D 5
Ferndale	29,675	B 6
Ferry	200	C 5
Ferrysburg	1,454	C 5
Fife Lake	347	D 4
Filer City	340	C 4
Filion	200	G 5
Flat Rock	1,931	F 6
Flint	163,143	F 6
Flushing	2,226	F 5
Forest Lake	110	C 2
Forester	100	G 5
Forestville	124	G 5
Forsyth	400	B 2
Foster City	300	B 3
Fosters	130	F 5
Fostoria	275	F 5
Fountain	247	C 4
Fowler	675	E 5
Fowlerville	1,466	F 6
Fox	20	B 3
Frankenmuth	1,208	F 5
Frankfort	1,858	C 4
Franklin Mine	90	G 1
Fraser	1,379	B 6
Frederic	250	E 4
Free Soil	208	C 4
Freeland	1,000	E 5
Freeport	452	D 6
Fremont	3,056	D 5
Frontier	265	E 7
Fruitport	638	C 5
Fulton	200	D 6
Gaastra	575	G 2
Gagetown	401	F 5
Gaines	352	F 6
Galesburg	1,200	D 6
Galien	610	C 7
Ganges	150	C 6
Garden	399	C 3
Garden City	9,012	B 7
Garnet	75	D 2
Gay	156	A 1
Gaylord	2,271	E 3
Genesee	600	F 5
Germfask	300	C 2
Gibbs City	200	G 2
Gilford	200	F 5
Gilmore	140	E 5
Girard	275	E 6
Gladstone	4,831	C 3
Gladwin	1,878	E 5
Glen Arbor	100	C 4
Glen Haven	25	C 4
Glenn	180	C 6
Glennie	250	F 4
Glenwood	110	C 6
Gobles	622	D 6
Goetzville	150	E 2
Good Hart	50	D 3
Goodells	600	G 5
Goodrich	525	F 6
Gotts	50	F 5
Gould City	350	D 2
Gowen	200	D 5
Grace	50	E 3
Grand Beach	105	C 7
Grand Blanc	998	F 6
Grand Haven	9,536	C 5
Grand Junction	350	C 6
Grand Ledge	4,506	E 6
Grand Marais	600	D 2
Grand Rapids	176,515	D 5
Grandville	2,022	D 6
Grant	646	D 5
Grass Lake	878	E 6
Grawn	175	D 4
Grayling	2,066	E 4
Green		F 1
Greenbush	100	F 4
Greenland	600	G 1
Greenville	6,668	D 5
Gregory	300	E 6
Grind Stone City		G 4
Grosse Ile	2,500	B 7
Grosse Pointe	6,283	B 7
Grosse Pointe Farms	9,410	B 6
Grosse Pointe Park	13,075	B 7
Grosse Pointe Shores	1,032	B 6
Grosse Pointe Woods	10,381	B 6
Gulliver	300	D 2
Gwinn	900	B 2
Hadley	275	F 6
Hagensville	100	F 3
Hale	500	F 4
Hamburg	350	F 6
Hamilton	600	C 6
Hamtramck	43,355	B 6
Hancock	5,223	G 1
Hanover	377	E 6
Harbor Beach	2,349	G 5
Harbor Sprs.	1,626	D 3
Harper Wds.	9,148	B 6
Harrietta	152	D 4
Harris	150	B 3
Harrison	884	E 4
Harrisville	485	F 4
Hart	2,172	C 5
Hartford	1,838	C 6
Hartland	260	F 6
Haslett	1,000	E 6
Hastings	6,096	D 6
Hawkins	50	D 5
Hawks	250	F 3
Hazel Park	17,770	B 6
Helena	75	G 5
Helmer	35	D 2
Hemlock	700	E 5
Henderson	200	E 5
Herman	155	A 2
Hermansville	800	B 3
Herron		F 3
Hersey	239	D 5
Hesperia	760	D 5
Hessel	200	E 2
Hiawatha	150	C 2
Hickory Corners	180	D 6
Highland Park	46,393	B 6
Hillman	442	F 3
Hillsdale	7,297	E 7
Hockaday	5	E 4
Holland	15,858	C 6
Holly	2,663	F 6
Holt	6,500	E 6
Holton	350	C 5
Home Acres	20,000	D 6
Homer	1,301	E 6
Honor	269	D 4
Hope	100	E 5
Hopkins	531	D 6
Horton	350	E 6
Horton Bay	50	D 3


MICHIGAN
SCALE OF MILES
0 10 20 30 40 50
State Capitals
County Seats
Canals
Railroads
A
88°
B
87°
C
86°
D
85°
E
F
G
47°
46°
45°
1
2
3
ISLE ROYALE
(NATIONAL PARK)
L. SUPERIOR
Same scale as main map
KEWEENAW
CAN.
Passage I
Blake Pt
Rock Harbor
Siskiwit Bay
89°
48°
Same scale as main map
LAKE SUPERIOR
HOUGHTON
ONTONAGON
GOGEBIC
IRON
BARAGA
WIS.
Ontonagon
Ironwood
Bessemer
Wakefield
Houghton
Hancock
L'Anse
Iron River
HIGHEST POINT
Government Pk
PORCUPINE MTS
90°
89°
LAKE SUPERIOR
KEWEENAW
MARQUETTE
ALGER
LUCE
CHIPPEWA
SCHOOLCRAFT
MACKINAC
DELTA
DICKINSON
MENOMINEE
IRON
BARAGA
EMMET
CHEBOYGAN
PRESQUE ISLE
CHARLEVOIX
ANTRIM
OTSEGO
MONTMORENCY
ALPENA
LEELANAU
GRAND TRAVERSE
KALKASKA
CRAWFORD
OSCODA
ALCONA
ONTARIO
North Channel
Manitoulin I
Drummond I
Str of Mississagi
False Detour Chan
Straits of Mackinac
Green Bay
LAKE MICHIGAN
W I S.
Marquette
Negaunee
Ishpeming
Munising
Sault Ste. Marie
Newberry
Manistique
Escanaba
Gladstone
Menominee
Marinette
Iron Mountain
Norway
Crystal Falls
St Ignace
Cheboygan
Petoskey
Charlevoix
Rogers City
Alpena
Traverse City
Gaylord
Grayling
Beaver I
Whitefish Bay
PICTURED ROCKS
Grand Marais
Sturgeon Bay
Kingsford
Florence



MILWAUKEE
Racine
Kenosha
Sheboygan
Manitowoc
Two Rivers
Green Bay
Ludington
Muskegon
GRAND RAPIDS
Holland
Kalamazoo
Battle Creek
Jackson
Lansing
Flint
Saginaw
Bay City
Midland
Pontiac
Ann Arbor
Ypsilanti
DETROIT
WINDSOR
TOLEDO
Monroe
Port Huron
SOUTH BEND
Benton Harbor
LAKE ST. CLAIR
Longitude West of Greenwich
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9581

Houghton	3,829	G 1
Houghton Lake		E 4
Houghton Point		E 4
Howard City	791	D 5
Howell	4,353	E 6
Hoxeyville	128	D 4
Hubbard Lake	150	F 4
Hubbardston	335	E 5
Hubbell	1,690	A 1
Hudson	2,773	E 7
Hudsonville	1,101	D 6
Hulbert	400	D 2
Huntington Woods	4,949	F 6
Huron City	55	G 4
Huron Mountain	20	B 2
Ida	950	F 7
Idlewild	450	D 5
Imlay City	1,654	F 5
Ina	30	D 4
Indian River	600	E 3
Ingalls	150	B 3
Ingallston	50	B 3
Inkster	16,728	B 7
Interlochen	150	D 4
Ionia	6,412	D 6
Iron Mountain	9,679	B 3
Iron River	4,048	G 2
Irons	30	D 4
Ironwood	11,466	F 2
Isabella	2	C 3
Ishpeming	8,962	B 2
Ithaca	2,377	E 5
Ivanhoe		F 5
Jackson	51,088	E 6
Jacobsville	145	A 1
Jamestown	300	D 6
Jasper	300	E 7
Jeddo	150	G 5
Jenison	300	D 6
Jennings	250	D 4
Johannesburg	250	E 4
Jones	300	D 7
Jonesville	1,594	E 6
Kalamazoo	57,704	D 6
Kalamo	135	D 6
Kaleva	346	C 4
Kalkaska	1,250	D 4
Kawkawlin	500	F 5
Keego Harbor	7,700	F 6
Kent City	506	D 5
Kenton	400	G 2
Keweenaw Bay	300	G 1
Kilmanagh		F 5
Kinde	571	G 5
Kingsford	5,038	A 3
Kingsley	425	D 4
Kingston	371	F 5
Kipling	335	B 3
Kneeland	60	E 4
La Salle	74	F 7
Labranche	25	B 3
Lachine	90	F 3
Laingsburg	942	E 6
Lake	300	E 5
Lake Angelus	123	*F 6
Lake Ann	99	D 4
Lake City	719	D 4
Lake George	145	E 5
Lake Leelanau	400	D 4
Lake Linden	1,462	A 1
Lake Odessa	1,596	D 6
Lake Orion	2,385	F 6
Lakeland	300	F 6
Lakeview	975	D 5
Lamont	350	D 6
L'Anse	2,376	G 1
LANSING	92,129	E 6
Lapeer	6,143	F 5
Laporte	300	E 5
Larkin	50	E 5
Lathrop	46	B 2
Laurium	3,211	A 1
Lawrence	679	C 6
Lawton	1,206	D 6
Le Roy	243	D 4
Leer	20	F 3
Leetsville	35	D 4
Leland	536	D 3
Lenox	975	G 6
Leonard	391	F 6
Leonidas	225	D 6
Leslie	1,543	E 6
Levering	387	E 3
Lewiston	700	E 4
Lexington	594	G 5
Lincoln	409	F 4
Lincoln Park	29,310	B 7
Linden	933	F 6
Linkville		F 5
Linwood	425	F 5
Liske	6	F 3
Litchfield	882	E 6
Livonia	17,534	F 6
Long Lake	100	F 4
Long Rapids	50	F 3
Loretto	350	B 3
Lovells	100	E 4
Lowell	2,191	D 6
Lucas	120	D 4
Ludington	9,506	C 5
Lum	300	F 5
Lupton	200	E 4
Luther	314	D 4
Luzerne	150	E 4
Lyon Manner	87	E 4
Lyons	683	E 6
Mackinac Island	572	E 3
Mackinaw City	970	E 3
Mancelona	1,000	E 4
Manchester	1,388	E 6
Manistee	8,642	C 4
Manistique	5,086	C 3
Manton	1,085	D 4
Maple City	190	D 4
Maple Rapids	645	E 5
Maple Ridge	75	F 4
Mapleton	60	D 4
Marcellus	1,014	D 6
Marenisco	1,300	F 2
Marilla	80	D 4
Marine City	4,270	G 6
Marion	879	D 4
Marlette	1,489	G 5
Marne	600	D 5
Marquette	17,202	B 2
Marshall	5,777	E 6
Martin	407	D 6
Marysville	2,534	G 6
Mason	3,514	E 6
Mass	520	G 1
Matchwood	100	F 1
Maybee	428	F 6
Mayville	888	F 5
McBain	506	D 4
McBrides	223	D 5
McIvor	50	F 4
McMillan	336	D 2
Mears	262	C 5
Mecosta	305	D 5
Melvin	204	G 5
Melvindale	9,483	B 7
Memphis	800	G 6
Mendon	844	D 7
Menominee	11,151	B 3
Merrill	809	E 5
Merritt	61	D 4
Merriweather	100	F 1
Mesick	359	D 4
Metamora	390	F 6
Metropolitan	250	A 3
Metz	35	F 3
Michiana	102	C 7
Michigamme	600	A 2
Michigan Center	3,012	E 6
Michillinda	50	C 5
Middleton	450	E 5
Middleville	1,047	D 6
Midland	14,285	E 5
Mikado	204	F 4
Milan	2,768	F 6
Milford	1,924	F 6
Millbrook	200	D 5
Millersburg	281	F 3
Millington	1,043	F 5
Minden City	359	G 5
Mineral Hills	333	G 2
Mio	975	E 4
Missaukee Park	30	D 4
Mohawk	900	A 1
Moline	300	D 6
Monroe	21,467	F 7
Montague	1,530	C 5
Montgomery	397	E 7
Montrose	937	F 5
Moorestown	53	D 4
Moran	310	E 2
Morenci	1,983	E 7
Morley	413	D 5
Morrice	401	E 6
Mount Clemens	17,027	G 6
Mount Morris	2,890	F 5
Mount Pleasant	11,393	E 5
Mountforest	50	F 5
Muir	466	D 5
Mullett Lake	75	E 3
Mulliken	411	E 6
Munger	250	F 5
Munising	4,339	C 2
Munith	500	E 6
Muskegon	48,429	C 5
Muskegon Heights	18,828	C 5
Nadeau	400	B 3
Nahma	750	C 3
Napoleon	530	E 6
Nashville	1,374	D 6
Nathan	76	B 3
National City	100	F 4
National Mine	250	B 2
Naubinway	200	D 2
Nazareth	500	D 6
Negaunee	6,472	B 2
Nestoria	32	A 2
New Baltimore	2,043	G 6
New Boston	800	F 6
New Buffalo	1,565	C 7
New Era	247	C 5
New Haven	1,082	G 6
New Lothrop	459	F 5
New Troy	300	C 7
Newaygo	1,385	D 5
Newberry	2,802	D 2
Newland	100	C 4
Niles	13,145	C 7
Nirvana	40	D 5
North Adams	499	E 7
North Bradley	300	E 5
North Branch	832	F 5
North Lake	200	B 2
North Manitou Island	15	C 3
North Muskegon	2,424	C 5
Northland	100	B 2
Northport	582	D 3
Northstar	285	E 5
Northville	3,240	F 6
Norwalk	25	C 4
Norway	3,258	B 3
Novi	1,000	F 6
Oak Grove	125	F 6
Oak Park	5,267	B 6
Oakley	333	E 5
Oberlin	5	E 4
Ocqueoc	90	F 3
Okemos	950	E 6
Old Mission		D 4
Olivet	887	E 6
Omena	80	D 3
Omer	321	F 4
Onaway	1,421	E 3
Onekama	435	C 4
Onondaga	423	E 6
Onsted	486	E 6
Ontonagon	2,307	F 1
Orangeville	900	D 6
Orchard Lake	696	F 6
Ortonville	702	F 6
Oscoda	1,800	F 4
Oshtemo	300	D 6
Osseo	300	E 7
Ossineke	150	F 4
Otisville	592	F 5
Otsego	3,990	D 6
Otsego Lake		E 4
Ottawa Beach	40	C 6
Ottawa Lake	200	F 7
Otter Lake	523	F 5
Overisel	350	C 6
Ovid	1,410	E 5
Owendale	307	F 5
Owosso	15,948	E 5
Oxford	2,305	F 6
Ozark	70	E 2
Painesdale	1,100	G 1
Palmer	825	B 2
Palms	100	G 5
Palmyra	250	E 7
Palo	300	E 5
Parchment	1,179	D 6
Paris	225	D 5
Parisville	150	G 5
Parma	680	E 6
Paw Paw	2,382	D 6
Payment	100	E 2
Paynesville	250	G 2
Peacock	25	D 4
Pearl Beach		G 6
Peck	471	G 5
Pelkie	25	G 1
Pellston	442	E 3
Pentoga	50	G 2
Pentwater	1,097	C 5
Pequaming	21	A 2
Perkins	500	B 3
Perrinton	383	E 5
Perronville	100	B 3
Perry	1,203	E 6
Petersburg	1,001	F 7
Petoskey	6,468	E 3
Pewamo	432	E 5
Pickford	600	E 2
Pierson	169	D 5
Pigeon	1,015	F 5
Pinckney	695	F 6
Pinconning	1,223	F 5
Pine River	24	F 5
Pinnebog	100	F 5
Pioneer	10	D 4
Pittsford	600	E 7
Plainwell	2,767	D 6
Pleasant Ridge	3,594	B 6
Plymouth	6,637	F 6
Pointe aux Barques	9	G 4
Pointe aux Pins	42	E 3
Pompeii	171	E 5
Pontiac	73,681	F 6
Port Austin	724	F 4
Port Hope	353	G 5
Port Huron	35,725	G 6
Port Sanilac	247	G 5
Portage	1,677	D 6
Portland	2,807	E 6
Posen	274	F 3
Potterville	624	E 6
Powers	510	B 3
Prescott	281	F 4
Presque Isle	75	F 3
Princeton	330	B 2
Prosper	150	E 4
Prudenville	800	E 4
Pullman	300	C 6
Puritan	150	F 2
Quincy	1,527	E 7
Quinnesec	600	A 3
Raco	100	E 2
Ralph	55	B 2
Ramsay	1,200	F 2
Rapid City	250	D 4
Rapid River	700	C 3
Rapson		G 5
Rasmus	40	E 4
Ravenna	551	D 5
Reading	1,125	E 7
Red Oak	51	E 4
Redman	40	G 5
Redridge	94	G 1
Reed City	2,241	D 5
Reeman	150	D 5
Reese	632	F 5
Remus	600	D 5
Republic	1,092	B 2
Rexton	200	D 2
Rhodes	107	E 5
Richland	389	D 6
Richmond	2,025	G 6
Richville	400	F 5
River Rouge	20,549	B 7
Riverdale	304	E 5
Riverside	500	C 6
Riverview	1,432	B 7
Rives Junction	350	E 6
Rochester	4,279	F 6
Rock	550	B 2
Rock Harbor	50	E 1
Rockford	1,937	D 5
Rockland	500	G 1
Rockwood	1,044	F 6
Rodney	75	D 5
Rogers City	3,873	F 3
Romeo	2,985	F 6
Romulus	1,300	F 6
Roosevelt Park	1,254	C 5
Roscommon	877	E 4
Rose City	446	E 4
Rosebush	507	E 5
Roseville	15,816	G 6
Rothbury	350	C 5
Rousseau		G 1
Royal Oak	46,898	B 6
Rudyard	800	E 2
Ruth	222	G 5
Saganing	67	F 5
Saginaw	92,918	F 5
Sagola	300	B 2
Saint Charles	1,469	E 5
Saint Clair	4,098	G 6
Saint Clair Shores	19,823	G 6
Saint Helen		E 4
Saint Ignace	2,946	E 3
Saint Jacques		C 3
Saint James	400	D 3
Saint Johns	4,954	E 6
Saint Joseph	10,223	C 6
Saint Louis	3,347	E 5
Salem	350	F 6
Saline	1,533	F 6
Samaria	315	F 7
Sand Lake	394	D 5
Sands	125	B 2
Sandusky	1,819	G 5
Sanford	550	E 5
Sans Souci	100	G 6
Saranac	885	D 6
Saugatuck	770	C 6
Sault Sainte Marie	17,912	E 2
Sawyer	800	C 7
Schaffer	200	B 3
Schoolcraft	1,078	D 6
Scotts	375	D 6
Scottville	1,142	C 5
Sears	76	D 5
Sebewaing	1,911	F 5
Selkirk	50	F 4
Seney	300	C 2
Shabbona	100	G 5
Shelby	1,500	C 5
Shepherd	899	E 5
Sheridan	535	D 5
Sherman	100	D 4
Sherman City	25	D 5
Sherwood	362	D 6
Shingleton	400	C 2
Shoreham	391	C 6
Sidnaw	400	G 2
Sidney	100	D 5
Silverwood	75	F 5
Sister Lakes	175	C 6
Sixlakes	221	D 5
Skanee	190	A 2
Skeels	7	E 4
Smiths Creek	400	G 6
Smyrna	350	D 5
Snover	350	G 5
Sodus	300	C 6
South Boardman	125	D 4
South Haven	5,629	C 6
South Lyon	1,312	F 6
South Manitou Island	24	C 3
South Range	712	G 1
South Rockwood	1,100	F 7
Southbranch	70	E 4
Spalding	600	B 3
Sparr	85	E 3
Sparta	2,327	D 5
Spencer	49	D 4
Spratt	52	F 3
Spring Arbor	650	E 6
Spring Lake	1,824	C 5
Springport	598	E 6
Spruce	50	F 4
Stalwart		E 2
Stambaugh	1,969	G 2
Standish	1,186	F 5
Stanton	1,123	D 5
Stanwood	189	D 5
Stephenson	791	B 3
Sterling	444	E 4
Steuben	39	C 2
Stevensville	480	C 6
Stirlingville	100	E 2
Stittsville	10	D 4
Stockbridge	1,098	E 6
Stonington	408	C 3
Stony Lake	38	C 5
Stronach	350	C 4
Strongs	250	E 2
Sturgis	7,786	D 7
Sullivan	250	C 5
Summit City	75	D 4
Sumner	150	E 5
Sunfield	400	D 6
Suttons Bay	485	D 3
Swartz Creek	1,000	F 6
Sylvan Lake	1,165	F 6
Tawas City	1,441	F 4
Taylor Center	20,000	B 7
Tecumseh	4,020	E 7
Tekonsha	647	E 6
Temperance	1,062	F 7
Temple	150	E 4
The Heights	100	E 4
Thompson	250	C 3
Thompsonville	313	C 4
Three Oaks	1,572	C 7
Three Rivers	6,785	D 7
Topinabee	390	E 3
Tower	400	E 3
Traverse City	16,974	D 4
Trenary	150	C 2
Trenton	6,222	B 7
Trout Creek		G 2
Trout Lake	350	E 2
Trufant	215	D 5
Turin	236	B 2
Turner	193	F 4
Tuscola	150	F 5
Tustin	229	D 4
Twin Lake	550	C 5
Twining	196	F 4
Ubly	743	G 5
Union City	1,564	D 6
Union Pier	700	C 7
Unionville	531	F 5
Utica	1,196	F 6
Van Dyke	21,000	B 6
Vandalia	360	D 7
Vanderbilt	410	E 3
Vassar	2,530	F 5
Vermontville	707	E 6
Vernon	678	F 6
Vestaburg	450	E 5
Vicksburg	2,171	D 6
Vogel Center	70	E 4
Volney	50	D 5
Vulcan	650	B 3
Wabaningo	12	C 5
Wahjamega	1,613	F 5
Wakefield	3,344	F 2
Waldenburg	350	G 6
Waldron	427	E 7
Walhalla	210	C 5
Walkerville	233	C 5
Wallace	200	B 3
Walled Lake	2,788	F 6
Walloon Lake	214	E 3
Waltz	350	F 6
Warren	727	B 6
Waters	40	E 4
Watersmeet	600	F 2
Watervliet	1,327	C 6
Watton	400	G 2
Waucedah	260	B 3
Wayland	1,591	D 6
Wayne	9,409	F 6
Webberville	600	E 6
Weidman	410	D 5
Wells	600	B 3
Wellston	150	D 4
West Branch	2,098	E 4
West Olive	81	C 6
Weston	270	E 7
Westphalia	459	E 6
Wetmore	150	C 2
Wexford	50	D 4
Wheeler	300	E 5
White Cloud	977	D 5
White Pigeon	1,113	D 7
White Pine		F 1
Whitefish Point	75	E 2
Whitehall	1,819	C 5
Whitmore L.	1,500	F 6
Whittaker	300	F 6
Whittemore	452	F 4
Willard	100	E 5
Williamsburg	200	D 4
Williamston	2,051	E 6
Willis	200	F 6
Willow Run	11,365	F 6
Wilson	450	B 3
Winegars	125	E 5
Winn	350	E 5
Winona	125	G 1
Wisner	98	F 5
Wolverine	318	E 3
Woodland	410	D 6
Wyandotte	36,846	B 7
Yale	1,641	G 5
Yalmer	200	B 2
Ypsilanti	18,302	F 6
Yuma	93	D 4
Zeeland	3,075	D 6
Zilwaukee	1,219	F 5

o room on map for name.

penetrate this region. In 1634 he passed through the Straits of Mackinac and explored the southern shore of the upper peninsula of Michigan, continuing through Wisconsin to the south end of Green Bay and down the Fox River. The Jesuit priests Raymbault and Jogues in 1641 founded a mission for the Indians at Sault Sainte Marie, but this did not survive.

In 1668 the French Jesuit missionary Jacques Marquette visited the outposts and organized the first permanent white settlement within the present state at Sault Sainte Marie. Three years later he established Michilimackinac, a mission station at St. Ignace, where the Straits of Mackinac connect the waters of Lakes Huron and Michigan (*see* Marquette).

In 1673 the French-Canadian explorer Louis Joliet joined Marquette on their famous trip across Lake Michigan to Green Bay, then down Wisconsin's rivers to the Mississippi. La Salle sailed the first ship, the *Griffon*, up the Detroit River in 1679. A permanent settlement on the river was begun by Antoine de la Mothe Cadillac, one of Louis XIV's soldiers of fortune. Impressed by the advantages of establishing a fort and trading post at what is now Detroit, he obtained the king's consent for his plan. He returned in 1701 with soldiers and colonists and built Fort Pontchartrain, named after the French minister to the colonies. In 1751 its name became Detroit.

For 60 years the French flag flew over this country until it was lost at the close of the French and Indian War, and the important settlements at Detroit, Sault Sainte Marie, and Mackinac passed into the control of the English (*see* French and Indian War).

The Conspiracy of Pontiac

The coming of the English was resented by Pontiac, chief of the Ottawa Indians and leader of the confederacy that included the Potawatomi and Ojibwa. In 1763 his confederacy and other tribes attacked British posts from Michigan to western New York. At old Fort Mackinac they killed all but one of the garrison. This man escaped because one of the Indians was a friend. Pontiac besieged Detroit but was forced to withdraw after five months.

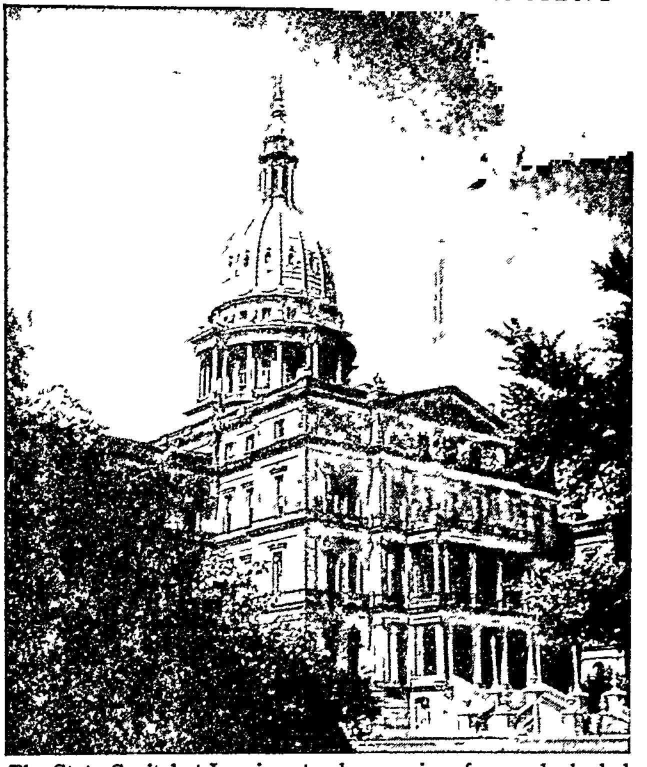
At the close of the American Revolution in 1783, Michigan formally passed into the hands of the Americans. The British did not leave all outlying forts. Control of Detroit did not pass until July 11, 1796. British occupation ended in 1814 (*see* War of 1812).

In 1787 Michigan became a part of the newly organized Northwest Territory. General Arthur St. Clair, its first governor, faced the problem of halting Indian attacks. When he failed in a campaign against them, President Washington sent Gen. Anthony Wayne, who was experienced in warfare with Indians. Wayne succeeded in making peace with the tribes so that Michigan could be opened to colonization. In 1796 the settlers in the Detroit area formed the district into Wayne County, thus honoring his name.

From Territory to State

In 1805 Michigan was organized as a territory. It got its name from the Indian word for "great lake." Shortly before Gen. William Hull, its governor, ar-

MICHIGAN'S SEAT OF GOVERNMENT



The State Capitol at Lansing stands on a rise of ground, shaded by fine old elm and chestnut trees. Its slight but towering dome reaches 267 feet. The building was completed in 1878.

rived from the east, Detroit was almost wiped out by fire. It was then a settlement of about 20 acres.

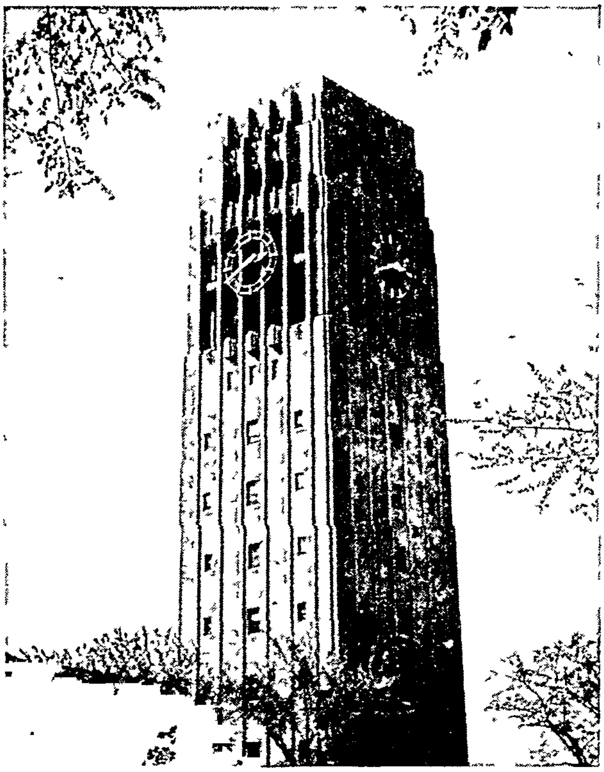
Up to this time the interior of the country was practically unknown. Less than a dozen settlements had been made on its borders, and the population in 1812 was about 5,000. In 1818 *Walk-in-the-Water*, the first steamboat on the Great Lakes, began regular trips between Detroit and Buffalo. In the same year public lands were opened to settlers. In 1819 Gov. Lewis Cass, who had succeeded Governor Hull, encouraged newcomers by a trip of exploration during which he established better relations with the Indians.

In 1820 Michigan had more than 20,000 inhabitants within its boundaries. The opening of the Erie Canal in 1825 was a further spur to settlement. During 1832–34 a cholera epidemic in this region took many lives, including that of the third governor of the territory, the able George B. Porter.

His successor, Stevens Thomson Mason, was but 21 years old, and some persons protested against the "boy governor." Mason proved equal to the task and proposed that the territory should petition to enter the Union as a state. Already 80,000 settlers had been attracted to its boundaries, 20,000 more than the Ordinance of 1787 held was necessary for organizing a state in the Northwest Territories.

Admission to the Union was delayed until 1837 by a dispute with Ohio over the southern boundary line. This resulted in the "Toledo War" (*see* Ohio). At first the capital was at Detroit. In 1847 it was moved to Lansing. (For additional history, *see* chronology in Michigan Fact Summary.)

CARILLON OF THE STATE UNIVERSITY



The University of Michigan at Ann Arbor is one of the nation's leading educational institutions. In its Burton Memorial Tower is one of the world's largest carillons, with 53 bells.

In Michigan's three constitutions, written in 1835, 1850, and 1908, local home rule has been increasingly favored. Amendments may be initiated by the signatures of 10 per cent of the voters. The initiative, referendum, and recall have been adopted.

Michigan was one of the first states to establish a free public-school system. It was the first state to have a state superintendent of schools. John D. Pierce, who held the office, 1837–42, is known as the "father of public-school education in Michigan."

State teachers colleges are located at Ypsilanti, Mount Pleasant, Marquette, and Kalamazoo. The University of Michigan at Ann Arbor, established in 1841, has long been a leader in education. Michigan State College of Agriculture and Applied Science, at East Lansing, opened in 1857—the first college of agriculture in the United States. (*See also* United States, section "North Central Region.")

MICHIGAN, LAKE. The only one of the Great Lakes lying entirely within the United States is Lake Michigan. Of the five lakes, it is third in size. It is 307 miles long and 118 miles at its greatest width. Its coast line extends 1,304 miles and its area is 22,400 square miles. Like Lake Huron, with which it connects through the Straits of Mackinac, its surface lies 580 feet above sea level. The lake's greatest depth is 923 feet.

The natural flow of its waters is northward. So low, however, is the water passing near Chicago that a comparatively shallow 30-mile channel gives the lake an outlet to the Illinois River and thence to the Mississippi. This channel, the Chicago Sanitary and Ship Canal, is a link in a continuous waterway for small vessels from the Gulf of St. Lawrence to the Gulf of Mexico (*see* St. Lawrence River).

In 1954 Congress authorized the United States to join Canada in the long-planned St. Lawrence Seaway Project. This will open ports on Lake Michigan and other Great Lakes to seagoing ships. Chicago and Milwaukee are now two of the seven greatest lake ports of the United States. A chain of deep-water canals, locks, and dams of the project will bypass rapids of the St. Lawrence River. These works and dredging on the Great Lakes will allow ocean vessels to carry grain, iron ore, and other cargoes at low freight rates between the Atlantic and ports on the Great Lakes.

Huge car ferries, operated by the railways, ferry freight trains across the lake between Ludington and Frankfort in Michigan, and Milwaukee, Manitowoc, and Kewaunee in Wisconsin. They are built large enough to carry 30 cars or more. They are so strong that they can cross in any weather, even crashing through the ice sheet that sometimes stretches from shore to shore. (*See also* Great Lakes.)

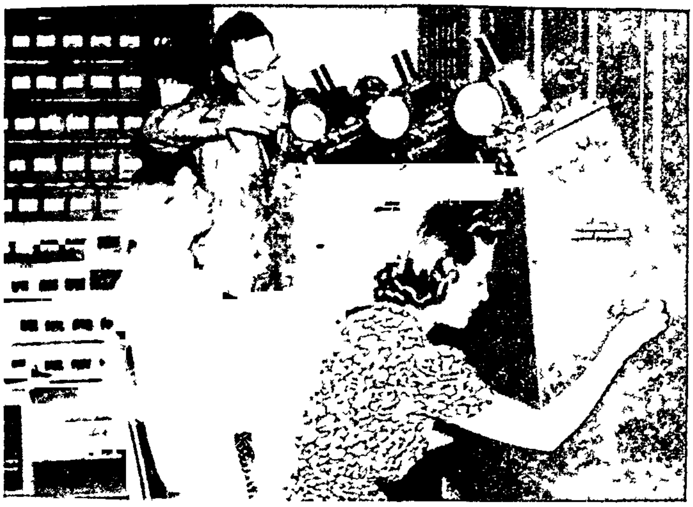
MICROFILM. As libraries, government bureaus, and business houses increase in size, the storage of their records becomes a serious problem. Protecting irreplaceable records from destruction by war or by any other catastrophe is also important. Microfilming, or microphotography, solves these problems. It is a mechanical process by which anything drawn, written, or printed can be photographed and reduced in size, often to one per cent of the original, on strips of safety film.

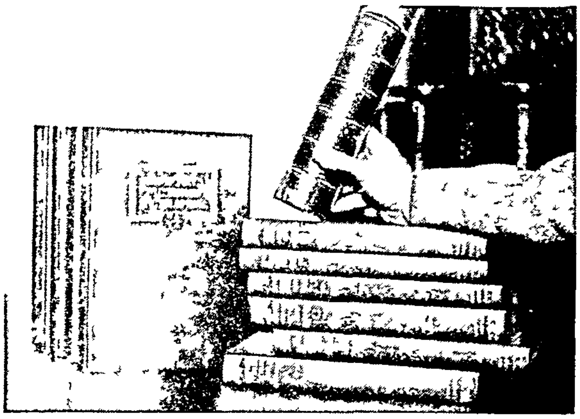
Special cameras are used, adapted to the type of material to be photographed, such as newspapers, bound volumes, or loose-leaf material. Some machines photograph both sides of the copy simultaneously and print the images side by side on the film. Sixteen-millimeter or 35-millimeter, noninflammable safety film is used, usually in 100-foot rolls. The film is read through a desk projector which returns the copy to normal size or to one and a half times the original size. Films not in use are stored in cartons measuring 4 by 4 by 1 inches.

Microfilming was first used on a large scale for V-mail during World War II. Letters written on special paper forms were photographed on 16-mm. film. The film was forwarded by air. At the receiving point the letters were reprinted and delivered to the men and women in the armed services. By using V-mail, one airplane could carry a load of letters that otherwise would have required 65 airplanes.

Nearly every branch of the federal government is now using microfilm to cut down its bulky files. Duplicate copies of valuable records are stored in separate places as a safeguard against their destruction. The Census Bureau is one of the largest users of microfilm in the country. Census documents, bound in huge 25-pound ledgers, occupy miles of shelving

MICROFILM SAVES SPACE AND MAKES IT EASIER TO USE HEAVY MATERIAL





Reading newspapers on microfilm is far easier than handling heavy bound volumes (left). These projectors are in a public library. The 15 volumes of Compton's Pictured Encyclopedia (right) are reduced to six rolls of film.

and cover thousands of square feet of floor space. Microfilming saves 95 per cent in floor space. Much of the original material must be retained, but the films simplify reference to the files and protect the originals from damage in handling.

Libraries are the second largest users of microfilm. By filming newspapers alone they save an enormous amount of space. Ten issues of *The New York Times* averaging 830 pages can be recorded on a single 100-foot roll of 35-mm. film. Through microfilm the Library of Congress has made available its reference library, containing more than 10 million books, to scholars all over the world. St. Louis (Mo.) University has had ancient manuscripts in the Vatican Library filmed for the use of its students of medieval history. Few scholars can afford to visit this great library. But its treasures are now being made accessible to everyone through microfilm.

Banks photograph checks, records of depositors' accounts, loan agreements, and other records; engineering firms photograph their complicated drawings; innumerable commercial firms microfilm records whose loss might put them out of business.

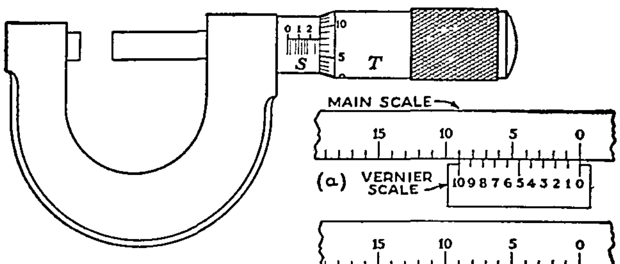
MICROMETER. A difference of $\frac{1}{1000}$ of an inch may not seem important, but some parts of an automobile or a sewing machine have to fit even closer than this. For such work machinists employ devices called micrometers (from the Greek terms meaning "small measure"). The commonest type is operated by a screw having 40 threads to the inch. Each turn of the screw, then, moves the measuring spindle $\frac{1}{40}$ or $\frac{25}{1000}$ of an inch. A scale revolving with the screw is divided into 25 parts and indicates, therefore, the fractions of a turn in units of $\frac{1}{1000}$ of an inch. Sometimes such a micrometer carries in addition a "vernier" scale with which a movement of $\frac{1}{10000}$ of an inch can be read. Micrometer readings are usually written as decimals or as *mils*, for example, the thickness of an ordinary sheet of newspaper is about .0035 in. or 35 mils.

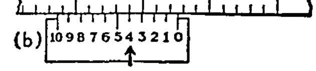
Micrometer devices of even greater delicacy are frequently attached to microscopes and telescopes. Some consist of simple scales ruled on glass with a fine-pointed diamond. These rulings are themselves made by "dividing engines" regulated on the micrometer principle and capable of marking as many as 120,000 lines to the inch. A common unit for such scales in scientific work is the *micron* ($\frac{1}{1000}$ of a millimeter or about $\frac{1}{25000}$ of an inch). The object to be measured is compared with this scale, both being equally enlarged. Another device moves the image of the object across a hairline in the eyepiece of the instrument, consisting of a spider's thread or a quartz fiber. The distance moved is indicated by the turn of a micrometer screw.

With the aid of micrometer controls, gauge blocks can be made that are accurate within $\frac{1}{1000000}$ of an inch at standard temperatures. Such blocks have been used in adjusting instruments for measuring the velocity of light. Similar blocks, though not necessarily so exact, are employed to check the accuracy of tools and dies in automobile and airplane factories.

Reading a Micrometer and Vernier

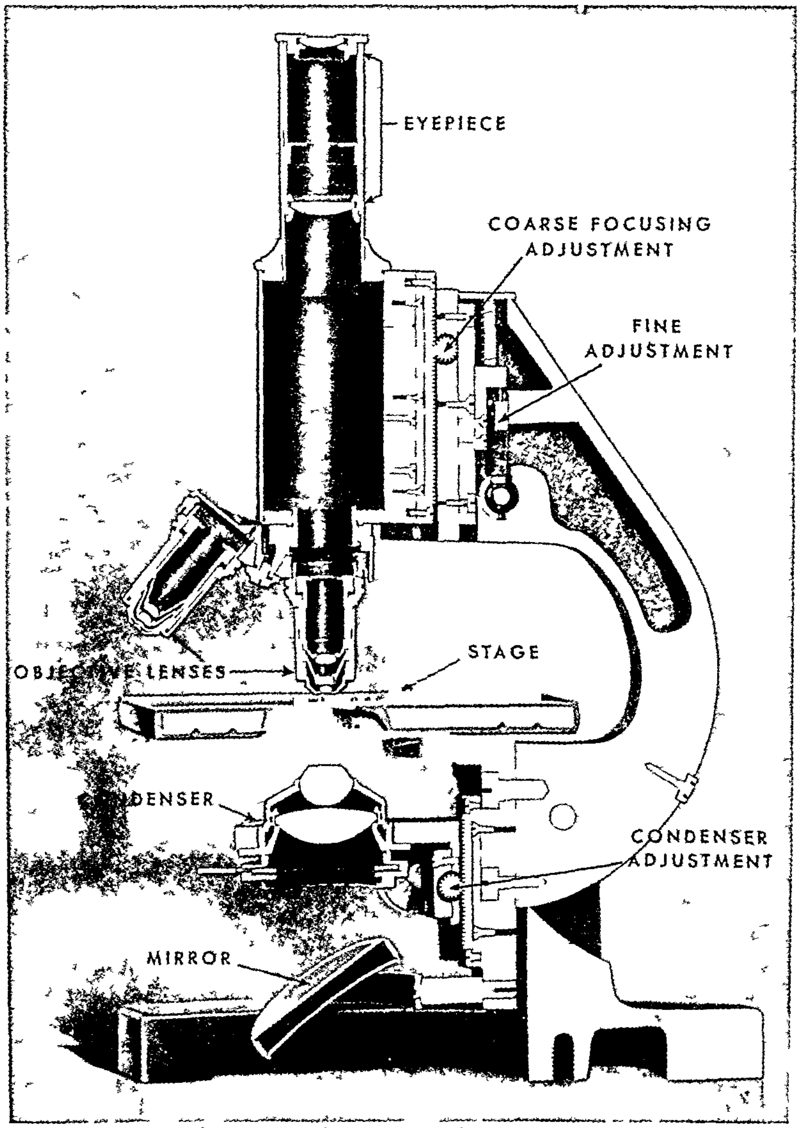
In the first picture below, the scale on the sleeve S shows two large divisions (each equal to .100 in.), plus three small divisions (each equal to .025 in.), making .275 in. In addition, eight divisions (each of .001 in.) are recorded on the circular scale of the thimble T, making the total measurement .275 plus .008 or .283 in.





The other drawings show how a vernier makes it possible to further subdivide the smallest division on any scale into tenths. The vernier (a) above has ten divisions in the space occupied by nine divisions on the main scale, each vernier unit being therefore one tenth shorter. How this system applies to a measurement is shown (b). Seven and a fraction units are indicated on the main scale. To determine the amount of that fraction, find the vernier division which most closely coincides with a main scale division. Obviously it is No. 4. The fraction then is $\frac{4}{10}$, and the whole measurement is 7.4.

EXPLORING *the Mysteries of the* INFINITELY SMALL



This cross-section of a compound microscope shows its chief working parts. The object to be examined is placed on the stage. The mirror throws a beam of light into the condenser, which brings it to a focus on the object. The rays from the object pass up through the objective lens which projects an enlarged image to the eyepiece, where it is further magnified and projected into the eye of the observer. A revolving mount allows different objective lenses to be moved into line at will

MICROSCOPE. Most of the pictures on these pages are formed of printed dots so close together that they cannot be distinguished separately by the naked eye. Yet there are only 120 of those dots to the inch and with a simple magnifying glass you can easily count them. A whole world of things exists, among which those printed dots rank as supergiants. This is the world you enter through a microscope lens.

The telescope adds much to human knowledge, but in many ways the knowledge gained by the microscope affects our lives more directly. The conquest of many diseases is due primarily to the use of the microscope in tracking down the bacteria or other organisms that cause them. Surgeons determine whether severe operations for growths in the body are necessary by microscopic examination of a section of tissue. Biologists rely on the microscope in their studies of cell life. It helps to determine the physical structure of steel, iron, and other metals, and to detect adulteration in foods, drugs, starches, and paints; and food inspectors depend on it to detect parasites in meats.

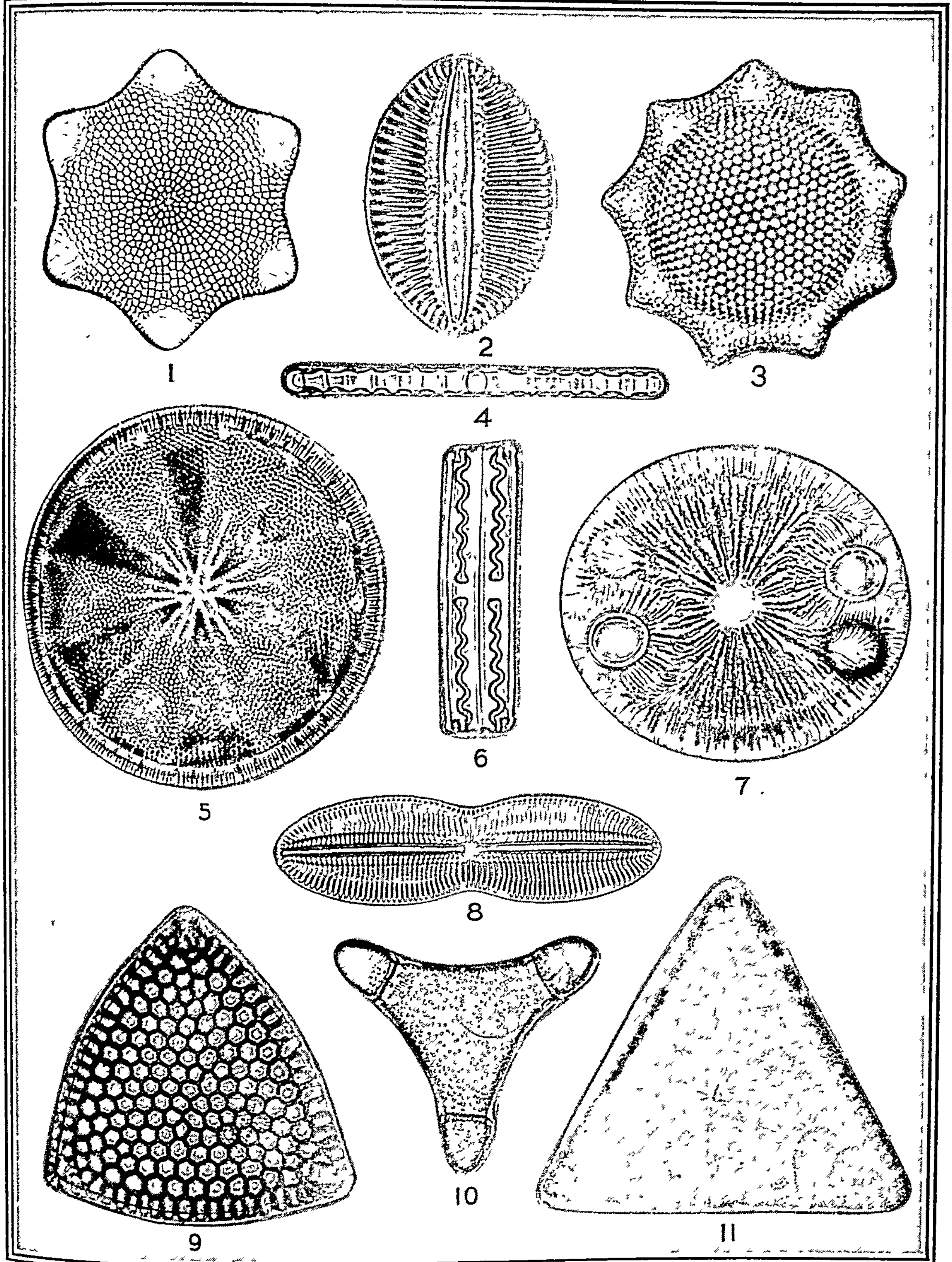
Invention of the Microscope

Ordinary magnifying glasses called "simple microscopes" were apparently known, at least as curiosities, in remote times. But the compound microscope was invented some time between 1590 and 1610. Galileo, the famous astronomer, is one to whom is ascribed the honor of inventing the microscope Remarkable discoveries in anatomy and biology were made by the use of both forms in the 17th and 18th centuries. For example, the Dutch scientist Leeuwenhoek, sometimes known as the "father of microscopy," showed that weevils, fleas, and other minute creatures are not "spontaneously generated" but come from eggs, and the Italian Malpighi was the first to see the capillary circulation of the blood, previously inferred by Harvey. Yet on the whole the microscope remained a marvelous toy until comparatively recent times.

The simple microscope may be a single lens, or a set of lenses close to one another, which give direct or one-stage magnification. A compound microscope uses a lens called the *objective* to produce a primary magnified image, and another called the *eyepiece* or *ocular* to magnify this primary image. Both objective and ocular, in actual practise, are composed of several lenses to neutralize the optical defects inherent in lenses made of a single kind of glass (*see* Lens).

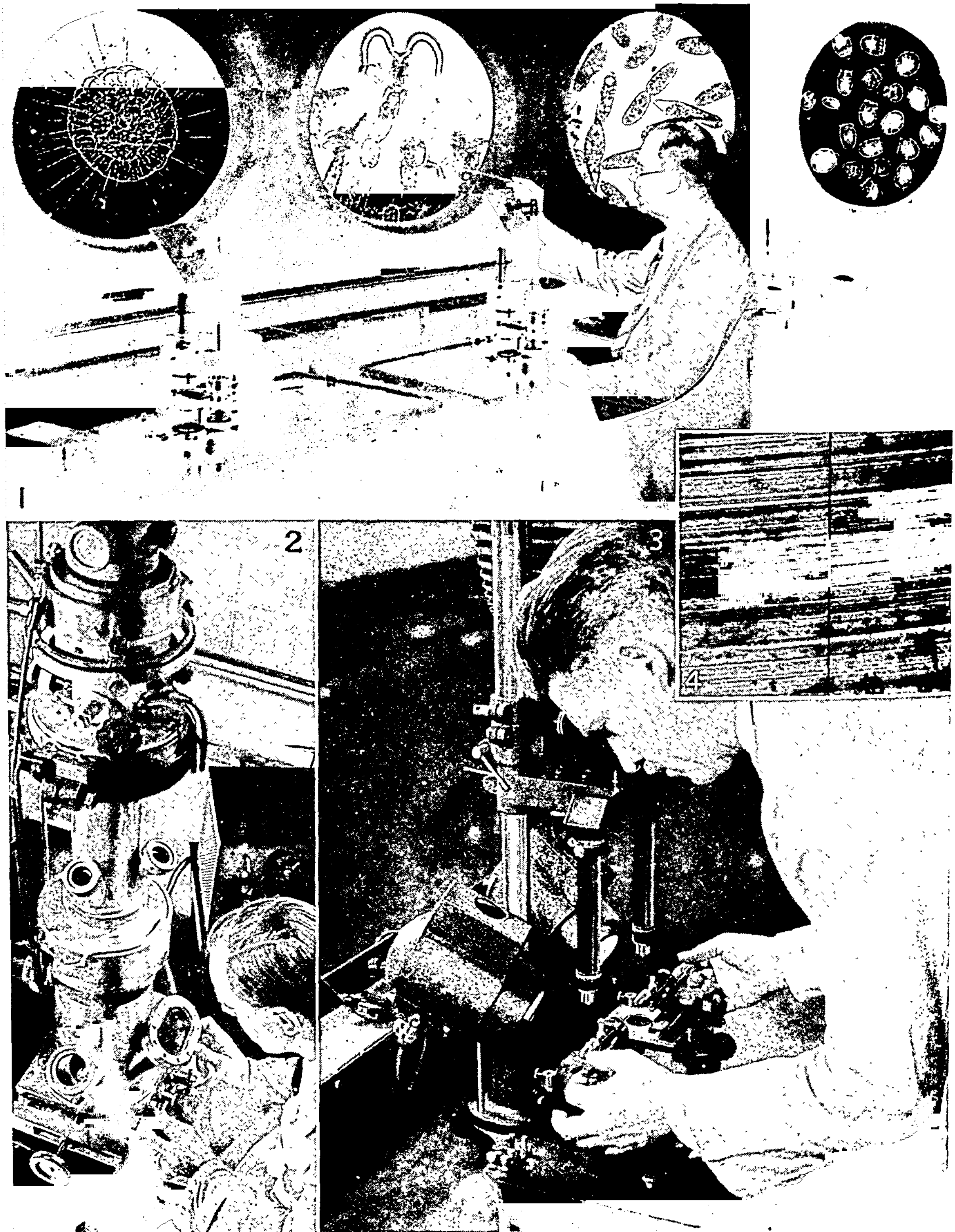
The high-power compound microscope is a delicate, elaborate, and expensive instrument, requiring skill, training, and patience in its use. The tube carrying the magnifying lenses has two focusing adjustments—the coarse instrument for moving the tube up or down rapidly, and the fine adjustment for very delicate changes. The object to be examined is placed on a stage, which can be moved back and forth to bring different parts of the object into view. If the object is transparent, it is mounted on a glass slide and lighted from below. The light is thrown up by a mirror through condensing lenses that focus it to a small

DIATOMS—TINY PLANTS OF EXQUISITE DESIGN



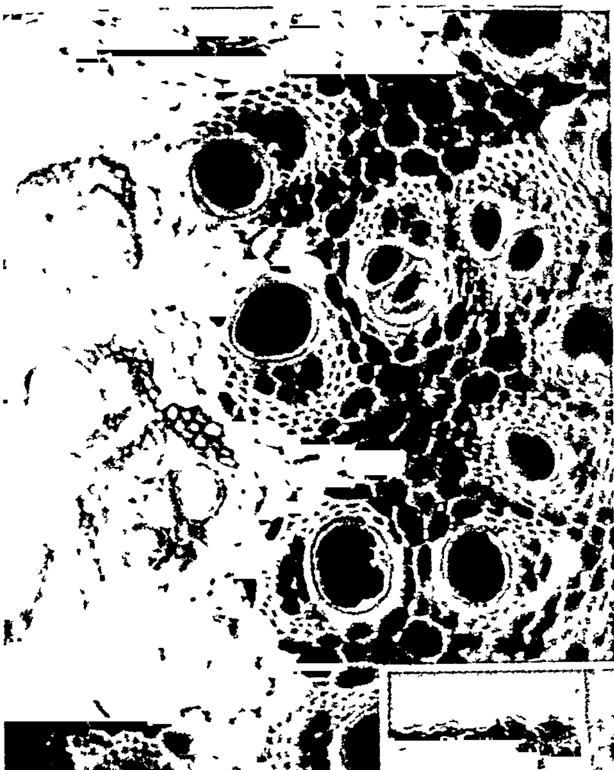
Housed in glass-like cases, whose beauty of form and pattern is almost unrivaled in nature, diatoms inhabit the waters in incredible numbers. These one-celled plants average less than $\frac{1}{250}$ of an inch in size, yet they provide the basic food of all animal life in the sea, and their fossil shells are put to many commercial uses. The photomicrographs above show us 11 of the 8,000 described species: 1. A six-angled form with delicate lacework. 2. Boat-shaped and striated. 3. Nine-angled, with honeycomb pattern. 4. Linear, resembling a lady's bar-pin. 5. Circular, "The Shield of the Sun." 6. Rectangular, ornamented with a scroll. 7. Oval, with radiating lines. 8. A "double" diatom. 9 to 11 Triangular forms, one concave, one convex, one straight-sided.

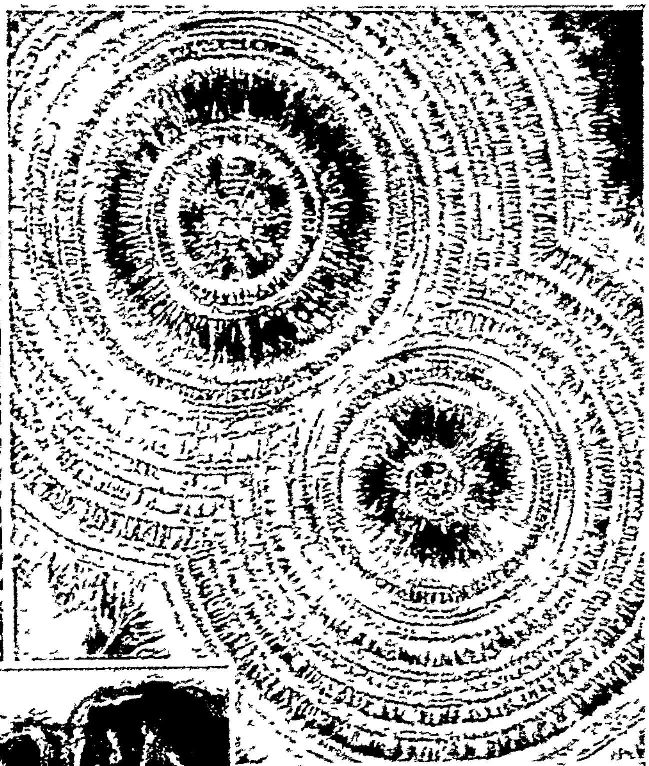
SPECIAL MICROSCOPES AND THEIR USES

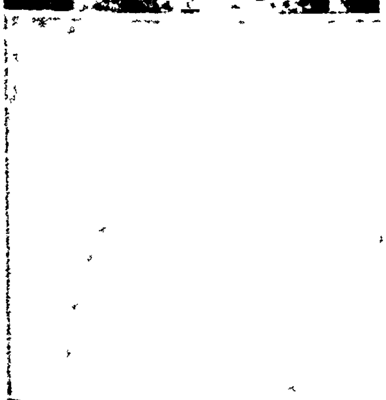


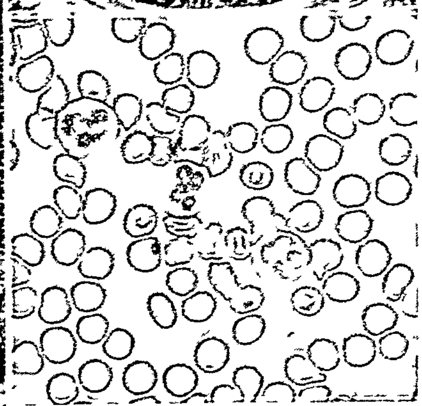
1. This microvivarium was devised by Dr. George Roemmert. Under each microscope is a sample of pond life strongly lighted from below. Enlarged images are directed against the transparent screens by mirrors. 2. This Siemens electron microscope passes a stream of electrons over an object. The changing pattern of the stream registers on a photographic plate and thus reveals structures ten times below the range of optical microscopes. 3. The comparison microscope has two lenses attached to a single eyepiece. 4. The comparison microscope brings together two bullets. Marks on them made by the gun barrel match closely and prove that both bullets were fired by the same weapon.

STRANGE PATTERNS FROM THE MICROSCOPIC WORLD









These photographs show how special methods of lighting and staining bring out details of objects for microscopic study. Upper left, a cross-section of a lily stem (magnified 150×), showing the pattern of sap vessels typical of monocotyledons. Upper right, crystal of asparagine, a chemical derived from asparagus, viewed by polarized light (*see* Light). Below, from left to right: anthrax bacilli (1,800×); cross-section of skin (100×) showing hair root; and sample of human blood (450×) stained for differential blood count showing three white corpuscles (leucocytes) among the red cells.

brilliant spot on the area to be examined. If the object is opaque, like a mineral specimen, it is lighted from above.

The eyepiece of a compound microscope may be equipped with a micrometer device for measuring an object. With a "camera lucida" attachment a highly magnified image may be projected on a screen or upon a sheet of paper where its structure may be traced with a pencil.

By placing a camera over the eyepiece of a microscope, photographs may be made with it. This art is called *photomicrography*. Though simple in principle, good high-power photomicrographs require great skill.

The Limits of the Microscope

Since the image formed by a microscope can be projected upon a screen, the magnification is virtually unlimited. But beyond a certain point, the increase of magnification merely makes the image larger without revealing any more detail. That is why microscopists judge a microscope lens not by its power of magnification, but by its *resolving power* —that is, its power to show separation between lines that are extremely close together.

Microscope lenses have been so perfected that the limit of their resolving power is as great as the wave-lengths of light will permit. We see objects by reflected or refracted light. A detail smaller than a half-wave of light cannot reflect or refract the wave and hence cannot be shown by optical methods. Violet light has the shortest waves visible to the human eye. With it, lines about eight-millionths of an inch apart may be resolved.

Yet a way has been found to detect and count ultramicroscopic particles with the ordinary microscope.

An object too small to *reflect* light may diffract it—scatter it all around—and may be seen against a dark background as a bright point. An "ultramicroscope," so called, is a microscope with attachments to reveal the presence of these ultra-small particles in a cross-beam of intense light. They appear very much as do dust particles dancing in a sunbeam.

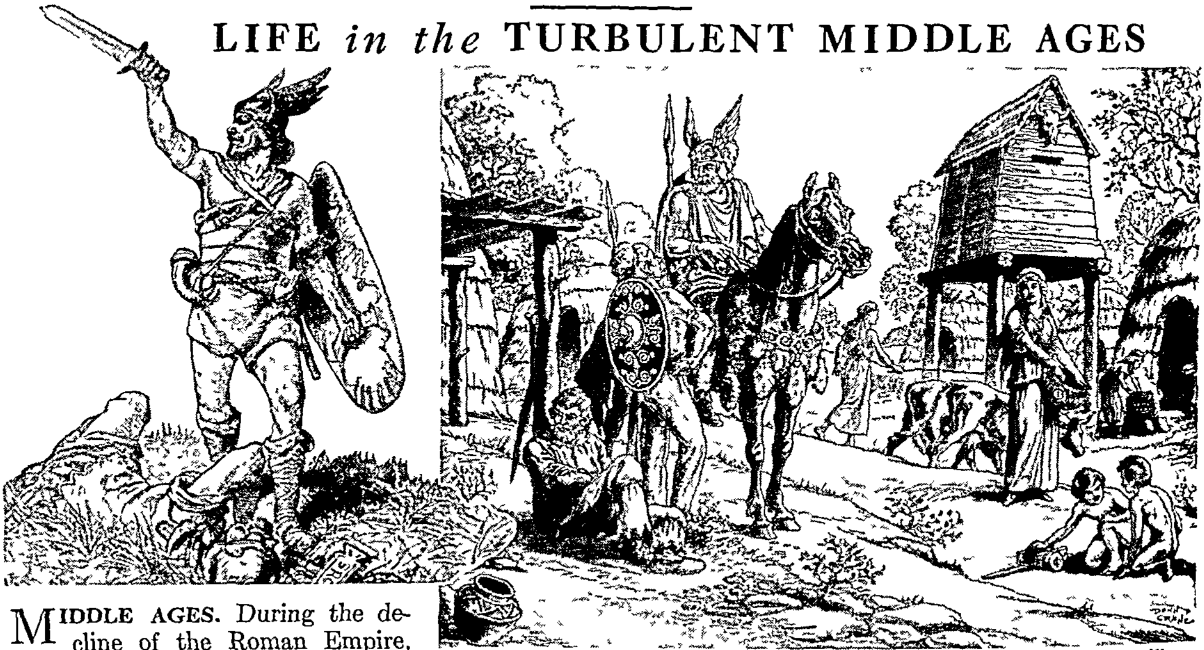
Microscopy with Invisible Rays

Photomicrographs made with ultraviolet rays reveal details over which visible rays would pass without reflection or refraction. Still smaller details are recorded by the electron microscope which focuses a stream of electrons upon the object. Every tiny variation in structure causes a variation in the electron stream, which then impresses its pattern on a photographic film. This instrument was invented in Germany in 1937. Its resolving power is more than a hundred times that of the visual microscope.

MIDAS. According to mythology, the god Dionysus promised Midas, an ancient king of Phrygia, whatever he should ask in reward for a kind act. Midas asked that everything he touched might turn to gold. When the request was granted, he found to his sorrow that there are many things more necessary, for even his food became gold, and he begged the god to take back the gift.

According to another story, Midas once decided a musical contest between Pan and Apollo, giving the prize to Pan. Apollo in revenge gave him a pair of ass's ears to show the god's opinion of his musical judgment. Midas hid his ass's ears under a cap, but his barber discovered the secret and was so excited by it that he dug a hole in the ground and whispered into it: "King Midas has ass's ears." A reed is said to have grown from this hole, and its whisperings spread the secret everywhere.

LIFE *in the* TURBULENT MIDDLE AGES



Before they invaded the Roman Empire, German barbarians lived in crude villages of beehive-shaped huts. Here a mounted chieftain confers with a tribesman. War was the chief work of the men. Women tilled the land. Their granary is the hut on stilts. At the left, Attila the Hun commands his horde on the march to Rome, 452 A.D.

MIDDLE AGES. During the decline of the Roman Empire, the migrations of a strong, rude people began to change the life of Europe. They were the German barbarians, or Teutonic tribes, who swept across the Rhine and the Danube into the empire. There they accepted Christianity. The union of barbarian vigor and religious spirit carried Europe to the threshold of modern times. That span from the ancient era to the modern is called the Middle Ages, or medieval period.

Roughly the Middle Ages cover some 1,000 years—from about 500 A.D. to about 1500 A.D. But the change from ancient ways to medieval customs came so gradually that it is difficult to tell exactly when the Middle Ages began or ended. Some historians say that the Middle Ages began in 476 A.D., when the barbarian Odoacer overthrew the emperor Romulus Augustulus, ending the Western Roman Empire. Other historians give the year 410, when Alaric the Visigoth sacked Rome. Yet others say about 500 A.D. or even somewhat later. It is equally hard to determine exactly when the Middle Ages ended, for decisive events leading to the modern age arose at different times. Historians say variously that the Middle Ages ended with the fall of Constantinople in 1453, or with the discovery of America in 1492, or with the onset of the Reformation in 1520.

Even before the fall of the Western Roman Empire in 476, life in Europe began to change. The German barbarians on the fringe of the empire had long hungered for Roman land. They were vigorous, restless people led by warrior chiefs. As they pushed down upon the empire in the 4th century they threw back Roman garrisons. Meanwhile the strength and discipline of the Roman Empire were being sapped by political decay, economic troubles, and decadent living (*see* Roman History). Surges of Goths, Van-

CHARLEMAGNE CROWNED HOLY ROMAN EMPEROR

On Christmas Day, 800, Charlemagne kneels in St. Peter's as Pope Leo III bestows the imperial crown. Lower right, Charlemagne's secretary inscribes "Karolo Augustus" (Charles Augustus).

dals, Lombards, Franks, Angles, Saxons, Burgundians, and other tribes sacked and pillaged the crumbling empire. Their customs gradually submerged Roman civilization. Highly developed systems of Roman law and government gave way to the rude forms of the barbarians. The invaders lacked the knowledge and skill to carry on Roman achievements in art, literature, and engineering. "The whole world," St. Jerome wrote, "is sinking into ruin." This early medieval period is sometimes called the Dark Ages.

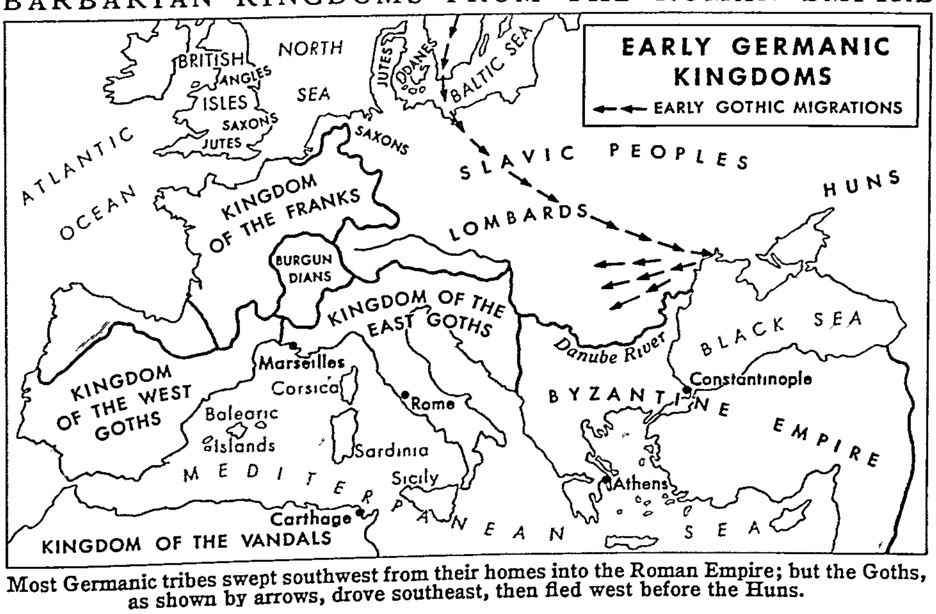
It was, however, a time of preparation, like working a field before planting seeds. Even as the barbarians pushed Roman civilization aside they brought fresh, robust ideas of their own. Those that most influenced the development of Europe arose from the barbarian belief in the rights of the individual. To the Romans the state had been more important than the individual. From the barbarians' ideal of personal rights grew their respect for women, their "government by the people," and their crude but representative law courts. Kings and chiefs were elected by tribal councils, which also served as courts of law.

The essential of a leader was bravery. If he cowered in battle, the tribe at once hoisted another warrior on their shields as leader. When a tribe faltered, the women's pleas often stemmed retreat. Though the barbarians enveloped Europe and drove into North Africa, only one group created a lasting state. This was the Franks. Their first great leader was Clovis, who in 481–511 established in Gaul the kingdom that was to become France (*see* Clovis).

In the reign of Clovis, Christianity began to help Europe from the Dark Ages. The first step was the conversion of Clovis in 496. Many barbarians had become Christians earlier, but most of them held the Arian belief, condemned as heresy by the Roman Catholic church (*see* Church, Christian). When Clovis became a Roman Catholic, his Franks began to receive the support of the bishop of Rome—that is, the pope. This opened to the Franks the residue of Roman culture sustained by the church. Its monks, living in retreats called *monasteries*, had preserved knowledge of Roman arts, crafts, and industries. They now began to spread this learning. (*See also* Monks.)

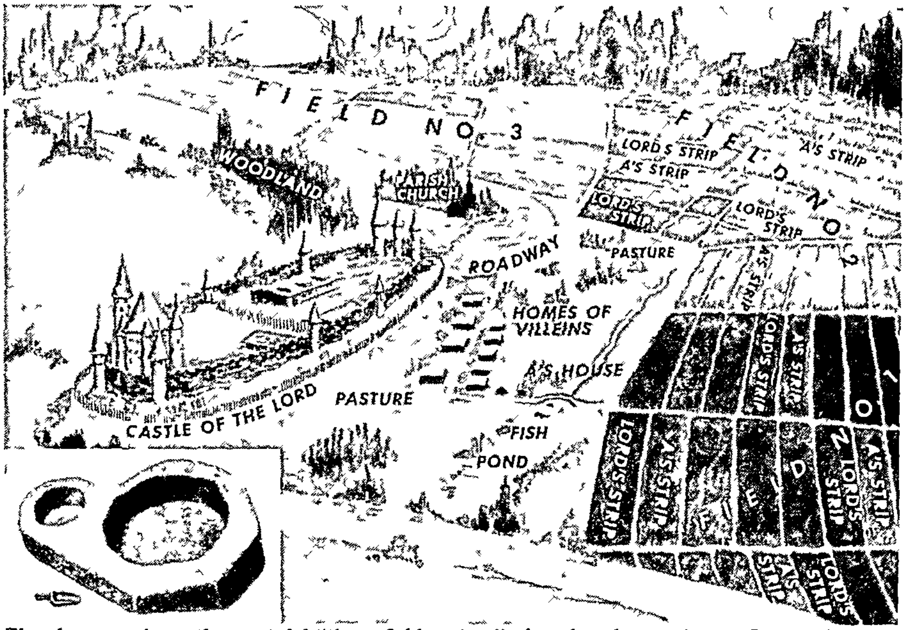
Christianity's influence widened when the great Charlemagne became king of the Franks in 768 and brought the Lombards and heathen Saxons under his sway. In 800 the pope proclaimed him ruler of the "Holy Roman Empire." Charlemagne vigorously sought to equip his people with education. He founded schools in monasteries and churches for the poor as well as for the nobility. (*See also* Charlemagne.)

BARBARIAN KINGDOMS FROM THE ROMAN EMPIRE



Most Germanic tribes swept southwest from their homes into the Roman Empire; but the Goths, as shown by arrows, drove southeast, then fled west before the Huns.

A FEUDAL LORD'S CASTLE AND THREE OF HIS FIELDS



This diagram shows the wasteful "three-field system" of medieval agriculture. Two fields were planted yearly, while the third lay fallow The planted fields were divided into strips for the lord and his serfs, or villeins The serfs farmed the lord's strips for the privilege of farming allotted plots Here one serf's acre strips are marked A. They are separated by unplowed turf Since the strips are so scattered they take a great deal of time to farm The other fields of the lord and serfs are at a distance. The insert at the left shows the tithe stone, which measured the lord's share of the grain.

As Charlemagne's empire passed to weak descendants, Europe was terrorized by new invasions. Seagoing Northmen swept down on England and the west coast of Europe and darted up rivers to raid inland. Hungarians drove from the east into Germany, France, and Italy. Moors from Africa and Spain slashed into southern Europe. (*See also* Mohammed; Northmen.)

The inept kings of the broken Holy Roman Empire could not provide defense. They turned to the powerful lords of the realm, sometimes granting land for aid. Many lords built fortified dwellings, or castles. Peasants built their villages of huts near the castles and served the lords in return for protection. They farmed the lords' land, worked in their households, and fought in their forces. A lord became a *suzerain* when he accepted the service of a lesser lord, or *vassal*. The suzerain gave the vassal a *fief*, a tract of land. In return, the vassal "did homage" to the suzerain—that is, the vassal pledged loyalty to the suzerain and promised to supply him with warriors.

As peasants exchanged their work—and vassals, their service—for protection, they necessarily gave up their independence. Even powerful suzerains were vassals of greater overlords, such as kings or bishops.

This way of life in the Middle Ages is called *feudalism*. The word comes from *feudum*, which in medieval Latin meant "possession," or "property." (The economic structure of feudalism is described in Feudalism)

The Peasants' Life

About nine-tenths of the people were peasants—farmers or village laborers. Only a few of these were *freemen*—peasants who were not bound to a lord and who paid only a fixed rent for their land. The vast majority were *serfs* and *villeins*. Theoretically, the villeins had wider legal rights than the serfs and fewer duties to the lords. But there was little real difference, and so most historians use the names interchangeably.

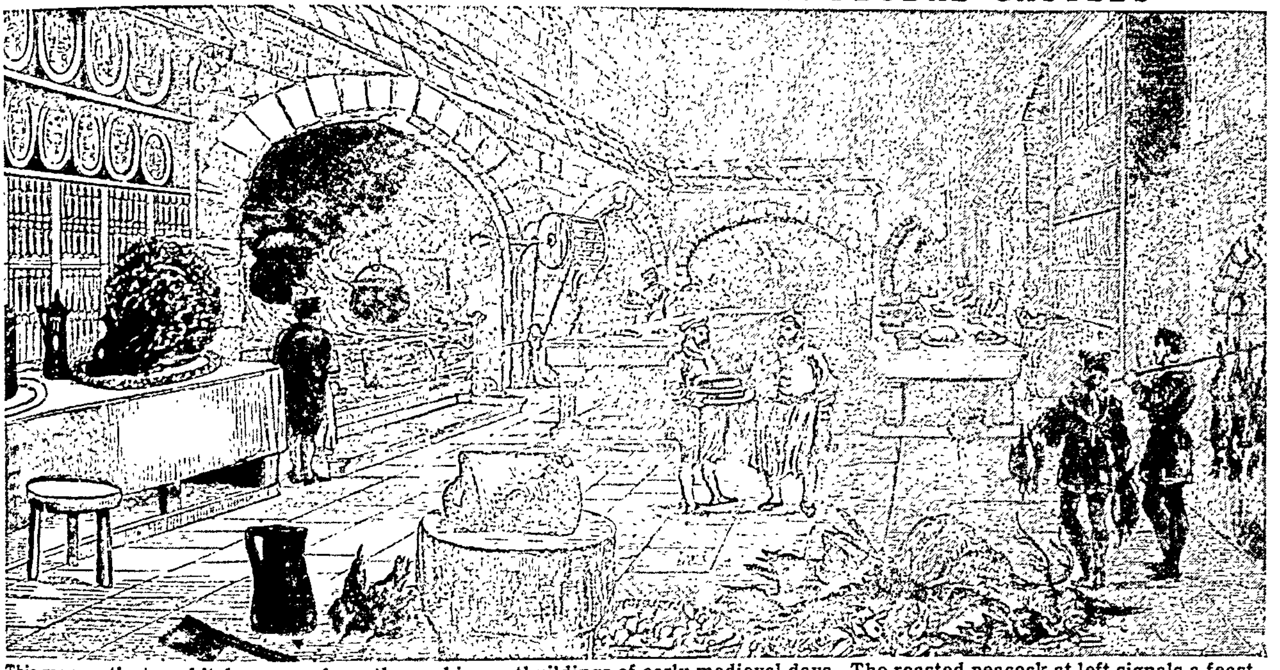
A peasant village housed perhaps 10 to 60 families. Each family lived in a dark, dank hut of wood, or even wicker, daubed with mud and thatched with straw or rushes. Layers of straw or reeds strewed the floor, fouled by the pigs, chickens, and other animals housed with the family. The one bed was a pile of dried leaves or straw. All slept in their rough garb, with skins of animals for cover. A cooking fire of peat or wood burned drearily day and night in a clearing on the dirt floor. The smoke seeped out a hole in the roof or through the open half of a two-piece door. The only furniture was a plank table on trestles, a few stools, perhaps a chest, and probably a loom, for the women made their own cloth. Every hut had a vegetable patch

All the peasants—men, women, children—worked to support their lord. They gave about half their time to work his fields, harvest, grind grain, cut timber, haul water and firewood, spin

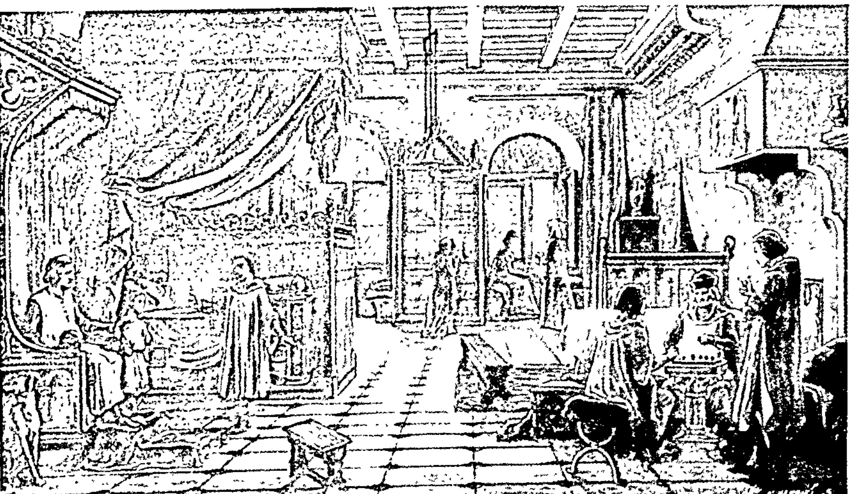
RAGGED SERF COMPLAINS TO FREE PEASANT

The free peasant at the left, with his spear and horn, is ready to hunt But if the serf were to hunt, he would be tried for poaching.

AT HOME WITHIN ONE OF THE LATER FEUDAL CASTLES



This mammoth stone kitchen grew from the cooking outbuildings of early medieval days. The roasted peacock at left signals a feast. Highly seasoned soup steams in the iron cauldron over the giant log fire. At center, a cook proudly shows a pastie. Two servants bring rabbits and game birds to add to the huddle of venison and other game on the flagged floor.



At the left, two French ladies of the 14th century listen to a troubadour. He is accompanied by a dwarf in motley. The view at the right is also of a 14th-century castle. By that time the lord's apartment had been partitioned from the great hall or moved to the donjon. The apartment now has windows and a chimney (right). The bed draperies let down to keep out the night air.

and weave, repair his buildings, and wait upon his household. In war, the men had to fight at his side.

Besides labor, peasants had to pay taxes to their lord in money or produce. In addition, they had to give a *tithe* to the church—every tenth egg, sheaf of wheat, lamb, chicken, and all other animals.

Famines were frequent. Plagues cut down the livestock. Frosts, floods, and droughts destroyed the crops. Bursts of warfare ravaged the countryside as the lords burned each other's fields and harvests.

The peasants' lot was hard, but most historians consider it little worse than that of peasants today. Because of the many holidays (holy days) in the Middle Ages, peasants actually labored only about 260 days a year. They spent their holidays in church festivals, watching wandering troups of jongleurs, journeying to mystery or miracle plays, or engaging in wrestling, bowling, cockfights, apple bobs, or dancing.

The Lord and His Lady in Their Castle

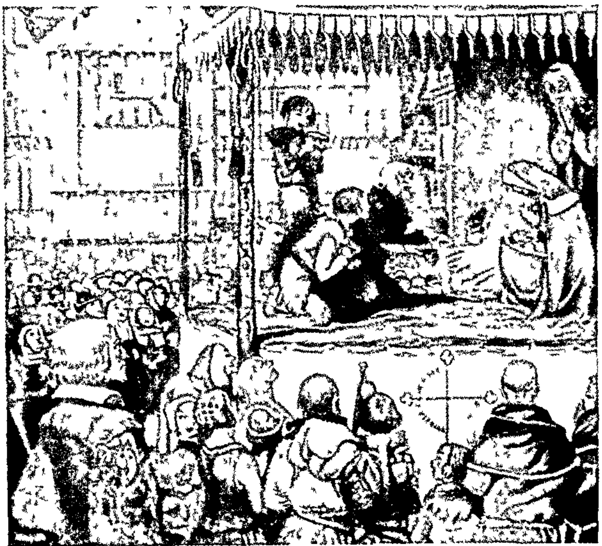
Supported by the brawn and taxes of the peasants, the feudal baron and his "gentle lady" would seem to have had a "goodly life." And in many ways they did, despite the lack of creature comforts and refinements.

About the 12th century palisaded, fortified manorial dwellings began to give way to stone castles. Some of these, with their great outer walls and courtyard buildings covered perhaps 15 acres. (For details of the structure of a typical castle, *see* Castle.)

Even in summer, dampness clung to the stone rooms, and the lord and his retinue spent as much time as possible outdoors. About dawn the watchman atop the donjon blew a blast on his bugle to awaken the

SPORT, THEATER, AND MIMIC WARFARE

This mural restored by Hans Holbein, the Younger, shows the strong, graceful flight of hunting hawks, or falcons.



Nobles and peasants traveled to towns when they could to watch a mystery play like this one, 'The Adoration of the Shepherds'.

castle. After a scanty breakfast of bread and wine or beer, the nobles attended mass in the castle chapel.

The lord then took up his business. He might first visit his son in the church school or perhaps hear the report of an estate manager. If a discontented or ill-treated serf had fled, doubtless the lord would order retainers to bring him back—for serfs were bound to the lord unless they could evade him for a year and a day. The lord would also hear the petty offenses of peasants and fine the culprits or perhaps sentence them to a day in the pillory. Serious deeds, like poaching or murder, were legally matters for the local court or royal "circuit" court.

The lady of the castle had many duties as chatelaine. She inspected the work of her large staff of servants. And she saw that her spinners, weavers, and embroiderers furnished clothes for the castle and rich vestments for the clergy. She and her ladies also helped to train the *pages*, well-born lads who went to live in the castle at the age of seven. For seven years pages were schooled in religion, music, dancing, riding, hunting, and some reading, writing, and arithmetic. At 14, they became *squires*.

The lord directed the training of squires. They spent seven years learning the practises of chivalry and, above all, of warfare. At the age of 21, if worthy, they received the accolade of knighthood. (For the ceremony of knighthood, *see* Knighthood.)

Nobles Eat Heartily, Play Strenuously

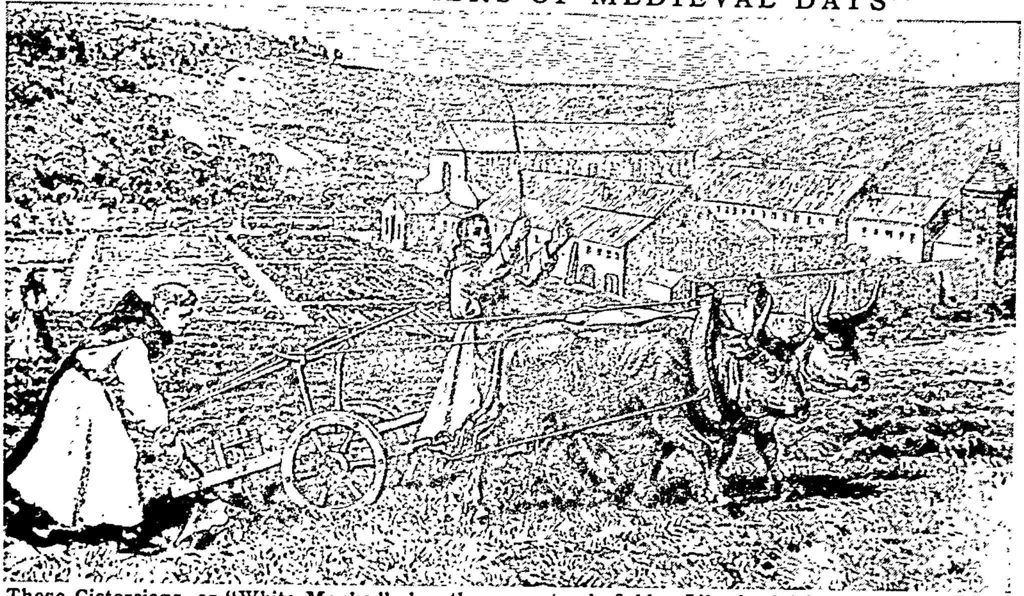
Sometime between nine o'clock in the morning and noon, a trumpet summoned the lord's household to the "great hall" for dinner. They were splendid "trenchermen," gustily eating quantities of soup, game, birds, mutton, pork, some beef, and often venison or boar slain in the hunt. In winter the ill-preserved meat smacked fierily of East Indian spices, bought at enormous cost to hide the rank taste. Great flat pieces of bread called *trenchers* served as plates and, after the meal, were flung to the dogs about the table or given to the poor. Huge pies, or *pasties*, filled

Plumed knights in full accouterment joust, or tilt, in a tournament. Although the knights charged head on, their great lances rarely penetrated the chest armor. Rather, a knight became victor when the force of his lance blow unhorsed his opponent.

with several kinds of fowl or fish, were relished. Metal or wood cups or leather "jacks" held cider, beer, or wine. Coffee and tea were not used in Europe till after the Middle Ages. Minstrels or jongleurs entertained at dinner.

Hunting, games, and tournaments delighted nobles. Even the ladies and their pages rode afield to loose falcons at game birds (*see* Falcon; Hawk). Indoors, before the great open fire, there were chess, checkers, and backgammon. Or a troubadour would chant and sing storied deeds of Charlemagne, Count Roland, or Arthur and his Table Round (*see* Arthur, King; Roland; Round Table; Music).

"THE BEST FARMERS OF MEDIEVAL DAYS"



These Cistercians, or "White Monks," plow the monastery's fields. Like feudal barons, the monastic orders grew their own foodstuffs. Most monasteries had walls like this one. Their great grants of land usually came from nobles. Some owned as many as 15,000 manors. Many owned whole towns.

But dearest to the warrior heart of the feudal lord was the tournament, an extravagant contest of arms. Visiting knights and nobles set up their pavilions near the *list*, or field of contest. Over each tent a bright banner fluttered to show the rank of a contestant—here a count, there a marquis or a baron (*see* Decorations; Flags). Their shields were emblazoned to identify each armor-clad warrior (*see* Armor; Heraldry). The first day of the tourney was usually devoted to *single combats*, in which pairs of knights rode full tilt at each other with 10-foot lances. The tourney's climax was the *mêlée*, when companies of the knights battled in perilous mimic warfare. A tournament cost a lord a fortune for hospitality and rich prizes given to the victors by the "queen of the tourney."

Feudal Warfare

Tournaments had grim value as practise for feudal warfare. Some battle or raid erupted almost daily, for medieval nobles settled their quarrels simply by attacking. If a lord coveted land, his couriers called his vassals to make a foray. The peasants, in quilted battle coats, trudged along to fight afoot with their pikes and poleaxes. Despite the innumerable outbreaks, casualties were surprisingly few, as long, exhausting battles were rare. Warring lords usually just burned the fields and villages of their enemies. After a skirmish, the defending lord and his vassals usually fled to the safety of the castle. It could withstand many a stubborn siege.

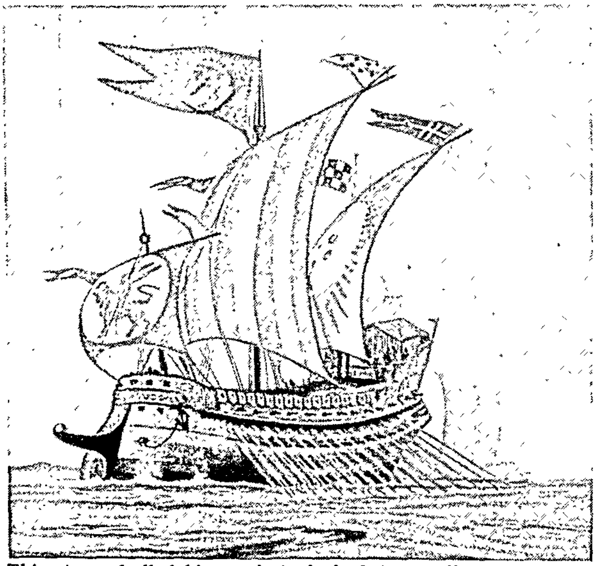
The Church Exerts Civilizing Influence

But amid the turmoil of the Middle Ages one institution stood for the common good. It was the Roman Catholic church. Many historians say that its spirit and its work comprised the "great civilizing influence of the Middle Ages."

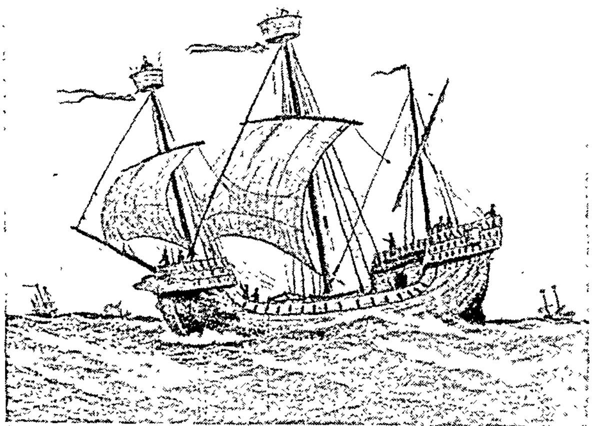
NUNS CARE FOR THE SICK IN WOMEN'S HOSPITAL

Many women of religious orders devoted their lives to hospital work. This scene, executed by Andrea del Sarto, shows nuns attending a ward in a women's hospital. The equipment is crude but typical of the times. This refuge for the sick indicates the efforts of the church to aid the helpless.

COMMERCE BEGINS TO REVIVE



This strong-hulled bireme is typical of the medieval Venetian argosies. Venice commanded the great Mediterranean trade.



Sailing ships like this carried the rich herring trade of the Hanseatic League. The Hansa cities ruled the Baltic commerce.

lived by tilling the land, like the peasants. But in the 11th century the Crusades began to stimulate the revival of commerce. Traveling merchants established headquarters in places of safety, such as by the walls of a castle or monastery. Places convenient to transportation grew rapidly, as on main roads or rivers or near the sea.

Wherever merchants settled, laborers and artisans came. Carpenters and blacksmiths made chests and casks for the merchants' goods, and carts to transport them. Shipbuilders turned out trading vessels. Butchers, bakers, and brewers came to supply food for the workers; and tailors and shoemakers to supply clothes. Others came to make the wares of trade.

By the 13th century Europe was dotted with towns, old and new. None was very large, and few had as many as 10,000 people. But they were introducing a new kind of life into medieval Europe, for the townspeople now lived by the *exchange of goods and services.* They were no longer self-sufficient like the little groups of peasants on the manors. They had to develop a new sort of organization, based on the idea of exchange. This laid the foundations for modern economic and social living.

As the cities grew rich they sought the right to govern themselves. The first to free themselves from the power of feudal lords were in Italy—Venice, Pisa, Genoa, Florence, and others. Towns in France were next to gain power, then along the Rhine Valley and on the Baltic coast—where cities of the Hanseatic League grew to enormous wealth and strength (*see* Hanseatic League). Some of the towns bought their freedom from the nobles and the church; others fought bitter battles to win it. A few were given it.

Life in the Walled, Cramped Towns

In the towns, the houses were packed together. This was because every town had to be a fortress, with stout high walls and a moat or river to protect it from hostile nobles, pirates, and robber bands. The smaller the walled enclosure, the easier it was to defend. The only open places were the market square in the town center, the cathedral, and the few gardens of the rich. Main streets led like spokes of a wheel from the market to the few gates in the walls. Building room was so cramped that houses were built in several narrow stories, the upper floors jutting out over the alleylike streets.

Few streets were paved. In wet weather people floundered almost knee deep in

ROBBER BARONS WAYLAY MERCHANT WAGON TRAIN

Highway robbery was so frequent in the Middle Ages that merchants tried to travel together in "caravans." This group has drawn pikes and lances to defend its wares against the charge of the renegade nobles. Other brigands on the twisting, unpaved roads included escaped serfs and fugitive criminals.

mud. The street was the only sewer. It sloped to the center, and refuse and chamber waste were flung into it. Pigs rooted in the odorous filth.

Wells, springs, and rivers were the only water supply. They were unprotected and untreated; so plagues were frequent.

Houses were not comfortable. Most had merely a framework of heavy timbers. The wall spaces were filled with woven reeds daubed with clay or plaster. Rushes or straw usually lined the floors. Fireplaces then had chimneys, and the peril of sparks on the thatched roofs was one of the worst hazards of town living. The house of the average citizen was his dwelling, "factory," and shop. Goods were made and sold on the ground floor. The owner and his family lived on the floor above. The upper stories were storage rooms and sleeping lofts for the workmen.

STUDENTS SEEK LEARNING IN A MONASTERY SCHOOL

Throughout the Middle Ages the church was the chief educator. The course of study was relatively limited, but this print seems to show that the lessons were not easy. The student standing at center is puzzled. Except for the eager pupil in the rear, his classmates look their sympathy. Note the lectern.

At night the medieval city was a pit of darkness and danger. There were no street lights—only an occasional dim lamp at the shrine of a saint. The hapless people who had to venture out at night usually took along one or two able workmen, with lanterns and weapons to ward off robbers. In some cities cables were strung across streets to hinder fleeing criminals.

But few working citizens were abroad at night. The day's work began at sunrise and ended at sunset. At 8 or 9 o'clock at night the great cathedral bell boomed the *curfew*. This was the signal for all to cover their fires with ashes, to lessen the peril of conflagrations in the night.

Churches and Gild Halls

The chief glories of the medieval towns were their churches and *gild* halls. The people of the various parishes and different cities vied with one another in building magnificent churches. The Gothic cathedrals were especially splendid and represented the labor of every art and craft. They are the artistic monuments of the Middle Ages (*see* Cathedral). The ornate gild halls represented the pride, wealth, and prestige of the medieval organizations which ruled the business of the city.

PLOTTING A WORLD MAP

The revival of map making helped to end the Middle Ages. Crude world maps aided daring mariners to explore.

All the business and professional men and the master workmen belonged to one or another of the many gilds of the town. The gilds were often called "fraternities," which means "brotherhoods." They kept the trade of the city in their own hands and made rules for each branch of trade. Each gild helped its own needy members and cared for widows and orphans. At first there were only *merchant* gilds. Then master workmen set up separate *craft* gilds for each trade and branch. Leather workers, for example, were split into many gilds, such as leather dressers, glovers, pocket makers, and slipper makers. Paris had some

350 craft guilds at the end of the 13th century. All guilds regulated the number of apprentices and workmen, hours of labor, and wages. (*See* Guilds; City.)

Feudalism Begins to Break Down

With the growth of commerce and towns, feudalism as a system of government began to pass. Eager to free themselves from the despotic power of the lords, merchants and artisans supported the kings. The movements of merchants and traders throughout the continent slowly broke down the isolation of feudal living, and people became more interdependent. Other changes also contributed to the breakdown of feudalism. They included the decline of serfdom, improved methods of warfare, development of national languages and literatures, and the rise of a feeling of national unity and patriotism.

The growing use of money enabled serfs to give money payment instead of service. Many bought their liberty. The ravages of the Black Death in 1348–49 left few peasants to work farms so they were able to get more concessions (*see* Black Death). Introduction of the longbow enabled foot soldiers to defeat the mounted knights. When they lost their fighting supremacy, they lost their power to rule. Even castles and city walls were no longer strongholds, as the innovation of gunpowder enabled armies to blast fortifications (*see* Warfare).

FRANCISCAN FRIAR AIDS SCIENCE

Roger Bacon, right, gives his 'Opus Majus' manuscript to a trusted messenger for Pope Clement IV. The Franciscans had attacked Bacon's visionary ideas. Yet he continued his experiments, advancing scientific knowledge.

As the towns helped to strengthen their power, the kings began to unite large territories under their rule. They tended to become despotic. In England, however, the Magna Carta broke the monarch's iron rule and prepared the way for more representative government in Europe (*see* Magna Carta). Seeds of nationalism were nurtured by the Hundred Years' War (*see* Hundred Years' War). From them grew the modern nations. The first were England, France, Spain, and Portugal. (*See* Nation.)

Middle Ages Merge into Renaissance

The changes in business, government, and social customs were steadily shaping a new life in Europe. Great stimulus came from a rising interest in intellectual and artistic achievements. These culminated in the great Renaissance, which—in a strict sense—means the revival of classical learning in the 14th and 15th centuries. The roots of the Renaissance grew from the Middle Ages. In the 13th and 14th centuries, near the end of medieval times, came the work of Dante, Petrarch, Boccaccio, and Bacon—and the art of Giotto, Ghiberti, Donatello, and Botticelli (*see* Renaissance).

REFERENCE-OUTLINE FOR STUDY OF THE MIDDLE AGES

Note: For the phase of history which precedes the period outlined here, see the Reference-Outline for Ancient History.

GENERAL MEDIEVAL HISTORY

I. Roman Empire of the West falls to German barbarian invaders (A.D. 476) E-431-2, M-236-7, G-143, H-451, V-437
   - A. Roman legions withdrawn from Britain E-358
   - B. Goths led by Alaric sack Rome A-129
   - C. Pope Leo I saves Rome from Huns H-451
   - D. Vandal army captures Rome V-438
   - E. Odoacer deposes Romulus Augustulus, last Roman emperor of the West R-188, M-236

II. Clovis founds Merovingian Dynasty and kingdom of the Franks (481–511) and accepts Christianity M-237, C-360, F-268

III. Theodoric the Great invades Italy in 488
   - A. Ostrogoth kingdom founded G-143
   - B. Siege of Ravenna R-79

IV. Byzantium, the Roman Empire of the East, reaches its greatest extent under Justinian I and Theodora (527–565) B-374, J-367-8
   - A. Ostrogoths driven from Italy G-144
   - B. Vandals in Africa conquered V-438

V. Lombard hordes overrun Po Valley (568) L-297

VI. Mohammed (570–632) and the rise of Mohammedanism M-329-30: Moorish invasion of Spain (711) S-320-1, M-389

VII. Merovingian Dynasty succeeded by Carolingians (751–987) F-268
   - A. Charles Martel defeats Saracens C-196, M-331
   - B. Pepin the Short, first Carolingian king, gives the exarchate of Ravenna to the papacy R-79

VIII. Charlemagne—first Holy Roman emperor C-186-8
   - A. Inherits kingdom of the Franks C-187
   - B. Conquers Lombards in Italy (773–4) L-297, C-187
   - C. Coronation at Rome on Christmas Day in the year 800 C-187-8, H-408, picture M-237
   - D. Revival of education and art C-188

Note: Lists of the Byzantine and Holy Roman emperors will be found in the Fact-Index.

IX. Charlemagne's empire divided—the Partition of Verdun in 843 marks the beginning of modern France and Germany C-188, E-432, V-451, H-408
X. The Crusades C-519-22: Crusading orders C-522
  A. Causes C-519: pilgrimages P-256-7
  B. Leaders C-519-20, 522, picture M-238*d*: Richard I, the Lion-Hearted, of England R-149-50, picture C-520; Louis IX (Saint Louis) of France L-318-19; Frederick Barbarossa, Holy Roman emperor F-281; Philip Augustus of France P-190; Saladin, leader of the Seljuk Turks S-25
  C. Lasting results of the Crusades C-522
XI. Fall of the Byzantine Empire (1453)—Sultan Mohammed II defeats Constantine XII and makes Constantinople the Ottoman capital B-374, T-220

Note: For additional details concerning medieval European history, see the Reference-Outlines for Europe, France, Germany, Austria-Hungary, Great Britain, Italy, Spain and Portugal, and Switzerland. For the relationship of this period of European history to the history of the world in general, see the Reference-Outline for World History.

MEDIEVAL INSTITUTIONS

I. The feudal system, based on agriculture, fits medieval needs F-60-2
  A. System of land holding F-60, A-71, picture M-238
  B. Serfdom succeeds slavery S-196-7, M-238
  C. Economic independence of the fiefs F-61
  D. Feudalism, as a system of government, begins to decline F-62, M-238*h*
II. Medieval church assumes temporal power F-61
  A. The Papacy P-64, C-302, R-79. See also names of popes in Fact-Index
  B. Rise of monasticism M-354: Benedictines and Franciscans M-355, 356, F-277

CONFLICT BETWEEN CHURCH AND STATE

I. Holy Roman Empire revived H-408, E-432: emperors O-430, H-334, F-281
II. Great Investiture Conflict
  A. Pope Gregory VII humbles Emperor Henry IV G-214, H-334-5, picture H-334
  B. In England W-138
  C. Settled by Concordat of Worms (1122) H-335
III. Quarrels of the House of Hohenstauffen and the Papacy
  A. Frederick Barbarossa, the Holy Roman emperor, bows to papal power F-281
  B. Innocent III strengthens Papacy J-358, O-430
IV. Decline of papal temporal power
  A. Babylonian Captivity of the church lasts for 70 years P-191, B-228, U-405
  B. The Great Schism of 1054 C-302
  C. Heresy strengthens the Hussites H-452

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    1. Knighthood and heraldry K-55-7, H-341, picture M-238*b*
    2. Titles of nobility D-40
    3. Troubadours R-179: Froissart F-301
  C. Medieval hospitals H-429*b*, picture M-238*c*
  D. Influence of the church M-238*c-d*
    1. Contributions of monks and nuns M-238*d-e*, pictures M-238*c*, *g*, *h*
    2. Pilgrimages grow into the Crusades M-238*e*, P-257, C-519-22
  E. Medieval life flowers in England E-362-3. See also the Reference-Outline for Great Britain.
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  E. Medieval drama D-131-2: miracle plays M-293, picture M-238*b*
  F. Literature of the late Middle Ages E-376, F-286, I-259
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V. Other arts: illuminated manuscripts B-236; music M-460; painting P-24-25*c*; sculpture S-78-78*a*; stained glass G-125; tapestries T-11. See also the Reference-Outlines for Music, Painting, Sculpture
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  A. Monks foster learning M-355, C-302, B-232
  B. Mohammedan contributions M-331, E-247
  C. Universities E-247-8, U-404, O-432, A-3
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Note: For the phase of history which follows the period outlined here, see the Reference-Outline for The Renaissance and The Reformation.

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'MIDSUMMER NIGHT'S DREAM'. According to the plot of this fanciful comedy, written by Shakespeare, Oberon, king of the Fairies, and Puck or Robin Goodfellow, his elfin lieutenant, set out to bewitch Titania, Oberon's fairy queen. Discovering two pairs of lovers wandering in the Athenian wood, they include them also in their enchantments, as well as a company of workmen who have come into the wood to rehearse a rustic play with which to win the favor of the duke of Athens on his wedding day.

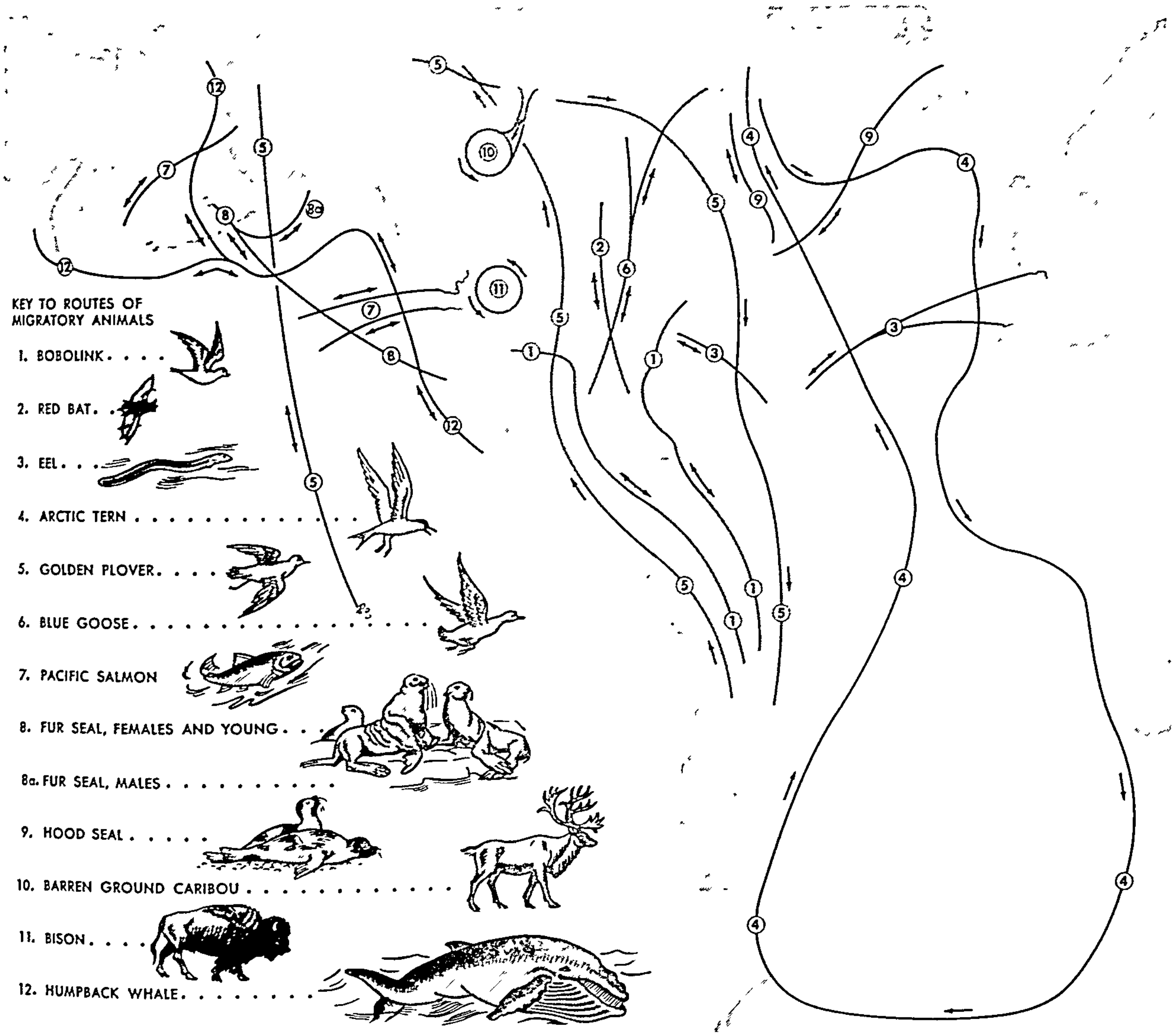
Queen Titania awakes from sleep to be most absurdly in love, under the enchantment, with "bully Bottom, the weaver," the chief of the clownish actors, on whom the mischievous Puck has placed an ass's head. In a highly comic scene her attendant fairies scratch Bottom's donkey-head, while their fond mistress kisses the "fair large ears" of her "sweet love." The wandering lovers wake to find their loves reversed, and charming Hermia is about to scratch out fair Helena's eyes. Puck, being a mischievous sprite, watches this sport in glee, but Oberon soon takes pity on them all, releases Titania from her foolish fancy, gives Bottom back his own foolish head, and the lovers their proper loves. Then at daybreak, all the human folk hasten back to Athens, the lovers to be wed and Bottom and his friends to present their play—about Pyramus and Thisbe. The plot concerns two lovers who, kept apart by their parents, conversed through an opening in the wall that separated their houses. One night they planned a secret meeting. Thisbe, startled by the roar of a lion, ran away, dropping her veil. When Pyramus arrived and found the veil torn by the lion's bloodstained jaws, he imagined Thisbe had been slain and stabbed himself. Thisbe, returning, found the body of her lover and ended her life with the same weapon. As presented by the rustics, the tragedy becomes a laughable burlesque. With this "tragical mirth" the play ends.

Here we see Puck, the mischievous sprite of 'Midsummer Night's Dream', sitting on a toadstool and surrounded by his elfish crew.

MIGNONETTE (*mĭn-yŏn-ĕt'*). The French have given this delicately fragrant flower the name of mignonette, which means "little darling." In Africa and Asia Minor the mignonette is a plentiful weed but in Europe and America it is a garden favorite. From the low mass of smooth green leaves rise spikes of inconspicuous blossoms of shaggy white and green, touched with bronze. In light soil the plants produce a continuous supply of fragrant flowers.

The scientific name of the mignonette is *Reseda odorata*. The flowers have 4 to 7 spreading sepals and the same number of petals attached beneath the ovary. There are 10 to 40 stamens; the anthers are large, dull, and a reddish-orange; the leaves, alternate and spatulate, are sometimes notched or 3-lobed; the stem is upright.

Across LAND *and* SEA *with* ANIMAL TRAVELERS



Many kinds of animals make long migratory journeys between their summer homes, where their young are born, and their winter homes. In most cases the animals make an annual round trip. Salmon and eels make the round trip only once in their life cycle. They die after returning to the home waters to lay their eggs. This map shows the routes followed by several of the most famous of the bird, fish, and mammal travelers.

MIGRATION OF ANIMALS. Many animals spend their lives in one region, or even in one spot. Other animals travel widely. Some make regular trips up and down mountainsides or go from inland streams to the sea. Others make long journeys back and forth across land and ocean. Such animals are *migrants,* and their travels are called *migrations.*

The most famous and beloved migrants are the birds. One of nature's marvels is their great spring flight from their winter homes to their summer nesting grounds. Every year with song and brilliant plumage they pour up from the south—orioles and tanagers from Peru, bobolinks from Argentina, hummingbirds from Mexico. Every year *billions* of birds rush northward from points as far away as Patagonia and the islands of Antarctica. The fall flight to the south is not as exciting as the spring migration, probably because the departure of the birds is quiet.

Most marvelous of all, many of the birds return to the same orchard or the very same field in which they nested the year before. We know that this is so, because birdbanders trap birds in harmless traps and attach a numbered aluminum identification band to the leg of each bird. The birds are then released. The serial number on the band leaves no doubt that a bird recaptured one year is the same bird that was banded the year before or five or ten years before.

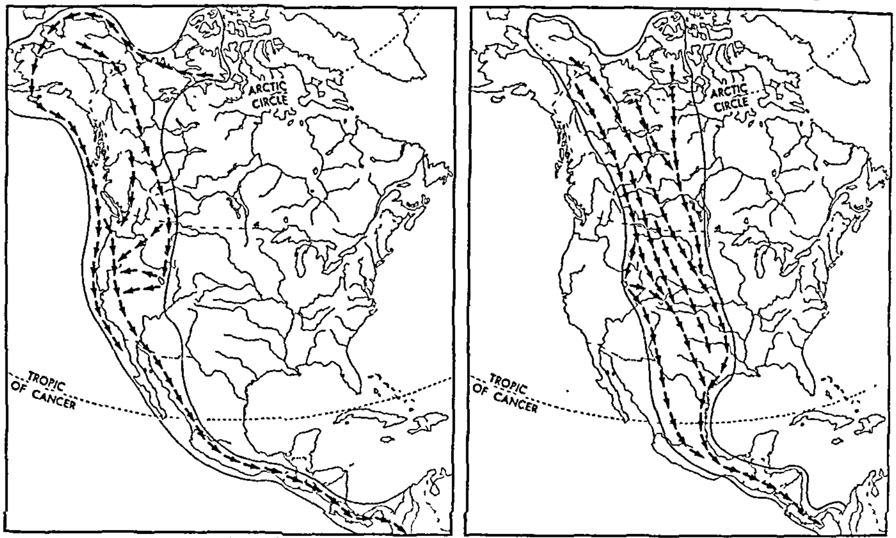
Some Famous Bird Travelers

The long-distance migration record is held by the Arctic terns of eastern North America. They nest in polar regions as far north as there is land. In the fall they fly across the Atlantic and down the coasts of Europe and Africa to the islands of Antarctica. The round trip may total 20,000 miles. Possibly terns lived ages ago in the Eastern Hemisphere. They may have found their way to North America by way of

Iceland and Greenland, perhaps over a land bridge that no longer exists. Now instead of taking the easier trip directly south over land, the birds retrace the migration route of their ancestors.

A similar explanation may account for the route of the bobolinks. Originally they nested along the eastern coast of the United States and Canada. Then they spread to the west-central part of North America. They winter in Brazil, as much as 6,000 miles away. In the western part of their range the birds have a safe short cut over land, all the way from Arizona and Texas across Mexico to South America. Bobolinks still follow the ancestral route. They go first to the Atlantic coast, then south to Cuba and Jamaica, then across hundreds of miles of open sea to the north coast of South America.

THE PACIFIC AND THE CENTRAL FLYWAYS



A migration route is the lane followed by different kinds of birds from breeding grounds to winter homes and back again. A flyway is the broader area where many migration routes come together.

The ruby-throated hummingbird makes a nonstop flight of 500 miles across the Gulf of Mexico to Yucatán. People used to think that this bundle of feathers, weighing no more than a penny, migrated as a "free rider" on the back of an eagle.

The eastern golden plover travels from the Arctic tundras of Canada to the pampas of Argentina. The immature birds migrate through the interior of the continent on the Mississippi flyway. The adult birds journey across northeastern Canada and then make a nonstop flight down the coast and across the sea to South America. In spring they return through the interior over the route used by the immature birds.

Not all birds migrate, nor do all migrants travel long distances. Most tropical birds remain in the same areas throughout the year. In the northern United States and Canada, the woodpeckers, nuthatches, chickadees, grouse, cardinals, juncos, jays, titmice, and others are permanent residents. Robins, bluebirds, and many others, found during the summer months from the Gulf of Mexico to Alaska, merely move to the southern part of their breeding range for the winter.

Some Explanations of Migration

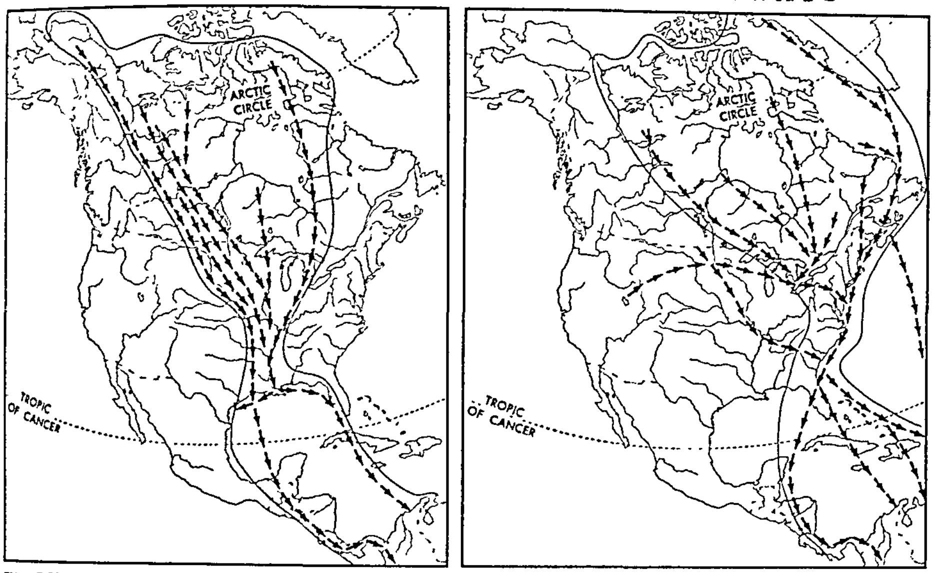
No one knows with certainty why birds migrate. In ancient times Aristotle and Pliny understood the movements of large birds, such as cranes, storks, geese, and ducks, that fly by day. The disappearance of smaller birds that apparently vanished in the night led to many curious beliefs. People supposed that they spent the winter in hollow trees and caves or that they hibernated in the mud of shallow lakes and swamps. Some birds, it was thought, lived for a part of their lives as different kinds of creatures. The goose barnacle got its name from the belief that it was the young of a goose which appeared on the coasts of Europe during the spring migration. One 18th-century writer tried to prove that birds flew to the moon for the winter.

Scientists now agree that birds migrate and they know where most birds go. Their knowledge has been obtained through banding. In the United States the bands are issued by the Fish and Wildlife Service. Anyone who catches a bird in a trap or picks up a dead or injured one wearing one of these bands should report the serial number to the Service, which has the record of where it was banded (*see* Birds, subhead "Bird Banding"). In this way the route of the Arctic tern was discovered. A bird banded on Eastern Egg Rock, Me., was recovered in the Niger River delta, in western Africa. Two birds banded in Labrador were found dead, one on the coast of France, the other near Natal, Union of South Africa. The winter home of the chimney swift was a mystery until 1944 when Indian hunters recovered 13 bands from swifts killed in a Peruvian jungle near the headwaters of the Amazon River.

One theory of migration says that prehistoric birds of the Northern Hemisphere were forced southward during the Ice Age, when glaciers covered large parts of Europe, Asia, and North America. As the glaciers melted, the birds came back to their homelands, spent the summer, and then went south again as the ice advanced with the winter. In time these comings and goings became habits, and birds now migrate though the glaciers have gone.

Another theory proposes that the ancestral home of all modern birds was the tropics. There they lived so well that the region became overpopulated. Many species were crowded northward. During the summer, these birds found plenty of room and food. In winter, however, food became scarce and they had to return to the tropics.

THE MISSISSIPPI AND ATLANTIC FLYWAYS



The Mississippi flyway is the most heavily traveled of the four flyways. In the north it spreads out across most of interior Canada. The Atlantic flyway has many migration routes westward.

A newer theory is that increasing daylight stimulates certain glands in the bird's body and prepares it for migration. One scientist is able to make birds migrate in midwinter by exposing them for two months to artificial daylight. Recoveries of marked birds indicate that they fly north as soon as they are set free. The conclusion is that the *urge* to migrate is determined by changes in the bird's body which take place under seasonal changes in the length of daylight.

This theory (called *photoperiodism*) would account for the fact that not all birds migrate at the same time. Each species seems to have its own schedule. The theory would also account for the regularity of migration. Birds arrive at a given place at the same time year after year. Unfavorable weather delays them only a few days. Total hours of daylight, rather than weather, start them on their way.

How birds find their way to the same areas year after year and why they follow their own particular route are still mysteries. They evidently do not follow known landmarks, for many young birds migrate alone without the guidance of experienced adults.

A few things about migration we know. Small land birds and shore birds fly by night and feed by day. Most waterfowl, hawks, chimney swifts, and swallows migrate by day. Normal speed of flight ranges from 20 miles an hour for the small songbirds to 60 miles an hour for ducks, swifts, and hawks.

The airplane has settled the question of how high most birds fly. Collisions between birds and airplanes seldom occur above 2,000 feet. Skyscrapers and lighthouses are among the great dangers of migration. Countless birds are killed by flying into them. Many birds fly so low that their calls may be heard and identified in the night.

We have spoken of the birds that make long nonstop flights, but most journeys are leisurely. After a flight of six or eight hours, the birds pause to feed and to rest for one or several days. Banding records indicate that a thousand-mile trip may take two to four weeks. Blackpoll warblers, for example, cross the Caribbean Sea in mid-April. They seldom reach the northern United States before May 15. As spring advances over Canada the blackpolls suddenly speed up, and they cover the remaining long trip to their breeding grounds in the Yukon Territory by June 1.

One scientist has enlisted the help of observers all over the country to watch the face of the full moon during the spring migration through telescopes and binoculars. The silhouettes of birds may be counted and the height at which they are flying estimated. His studies indicate that most night migrants travel until midnight but come to earth soon after.

In some cases the males migrate first. They go ahead to select the nesting site in preparation for the arrival of the females. In other cases males and females travel together and select their mates along the way. Geese, which mate for life, travel as couples in large flocks. In the fall, female shore birds often depart first, leaving the males with the task of caring for the young.

Other Animals That Migrate

Many animals undertake migrations similar to those of the birds; that is, they move at regular intervals from a breeding place to another location where climate and feeding conditions are more favorable. In a true migration the animal always returns to the original area.

The Barren Ground caribou of northwestern Canada move south from the shores of the Arctic Ocean in the fall after the mating season. The does and young animals travel together in small companies, moving slowly, often in single file. The old stags follow later. From December to March the caribou move in a great circular, counterclockwise path, apparently following good pasturage. Early in March, just as mosquitoes are beginning to swarm over the plains of their winter range, the caribou funnel out toward the northeast. The does reach the northern part of the range shortly before giving birth to their young.

Herds of bison, or American buffalo, once moved southward for 200 to 400 miles as winter drew near and started north again with the return of mild weather. They traveled in a roughly circular route. Deer, elk, and bighorn sheep migrate to snow-free valleys in autumn and in the spring return to the mountains where their young are born.

Red bats make long flights from the northern limits of their range in Canada to the Southern States. Individuals have been seen hundreds of miles at sea, apparently on their way to tropical islands. They are found in Bermuda in the winter.

Sea-dwelling mammals also migrate. The female fur seals and their young winter in the Pacific Ocean as far south as San Diego, Calif. The old bulls remain mostly in the Gulf of Alaska and south of the Aleutian Islands. In the spring the bulls return to the breeding grounds on the Pribilof Islands. The females and young follow later, making a 3,000-mile journey to these tiny islands in the Bering Sea. They arrive just in time for the females to give birth to their young. They remain near the Pribilofs during the summer until the pups are able to care for themselves, when they again go south.

California gray whales frequent the coast of California from early winter to late spring. At this time their young are born in the bays and lagoons of the lower coast. As summer draws near, the animals work their way north close to the coast to the Arctic Ocean and the Sea of Okhotsk. On the Atlantic Ocean, the humpback whales are found off Bermuda in the winter. As spring approaches they leave for the waters around Greenland.

Life-Cycle Migrations

A somewhat different type of migration is shown by various fishes, amphibians, and other sea-dwelling creatures. This movement is a part of the life cycle of the individual; in some cases there is no return journey. The most famous examples are the salmon and the eels. Salmon swim 2,000 miles or more from the open ocean up the very river in which they were born several years before in order to lay their eggs in fresh water. The exhausted, battered fish die after spawning, but their young return to the sea (*see* Salmon).

Equally dramatic is the story of the eels of eastern United States and western Europe. The adults live in rivers that empty into the ocean. When it is time for breeding, they swim several thousand miles to the deeps of the Sargasso Sea, south of Bermuda in the Atlantic Ocean. There they lay their eggs and, like the salmon, die soon after. Their young return to the fresh-water home of the parents (*see* Eel). The sea lampreys, or lamprey eels, do just the opposite. They live in salt water and breed in fresh water.

Land crabs visit the sea to lay their eggs so that the young may pass the early stages of their lives in salt water. Marine turtles, on the other hand, visit sandy shores to lay their eggs. Toads live as tadpoles in shallow pools or marshes and return to the pools to lay their eggs. They migrate to dry land between the breeding seasons.

Other Types of Migration

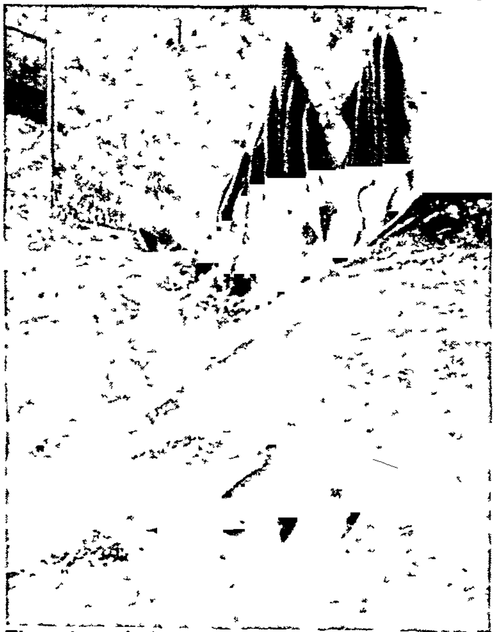
The term "migration" is often used for other types of travel that are not truly seasonal or related to reproduction. Snowy owls, for example, "migrate" southward when their food becomes scarce in the North.

Another type should be called an "emigration" rather than a migration, for there is no return journey. A remarkable example is that of the lemmings, relatives of the field mice. They are small, heavy-bodied rodents, five or six inches long, with very short tails and small ears. They live in Arctic regions around the world. Their food is the vegetation of northern plains and forests. They are themselves one of the chief foods of the snowy owls, foxes, ermines, and other meat-eating creatures.

Periodically, the lemmings increase enormously in numbers. They soon exhaust their food supply and begin to leave the area. They pour over mountains and across rivers, eating everything in their path. In Scandinavia they eventually reach the sea and plunge in to drown by the hundreds of thousands. In Canada they are less likely to encounter large bodies of water but eventually die of exhaustion and starvation. Strangely, not all of a colony emigrate; a few remain behind to establish a new generation.

Gray squirrels periodically make the same type of mass emigration when they increase in numbers. Like the lemmings, they move blindly to their death.

MIGRATING SALMON AND LAMPREYS



The salmon is leaping up a step in the Bonneville Dam fish ladder. On the wall behind it, lamprey eels are climbing by means of suckerlike disks in their heads. Both are traveling upstream to lay their eggs.

The flights of monarchs (butterflies) and dragonflies are believed by some authorities to be "dispersal movements" rather than true migrations; that is, the insects are simply scattering. Many monarchs winter in the areas in which they hatched.

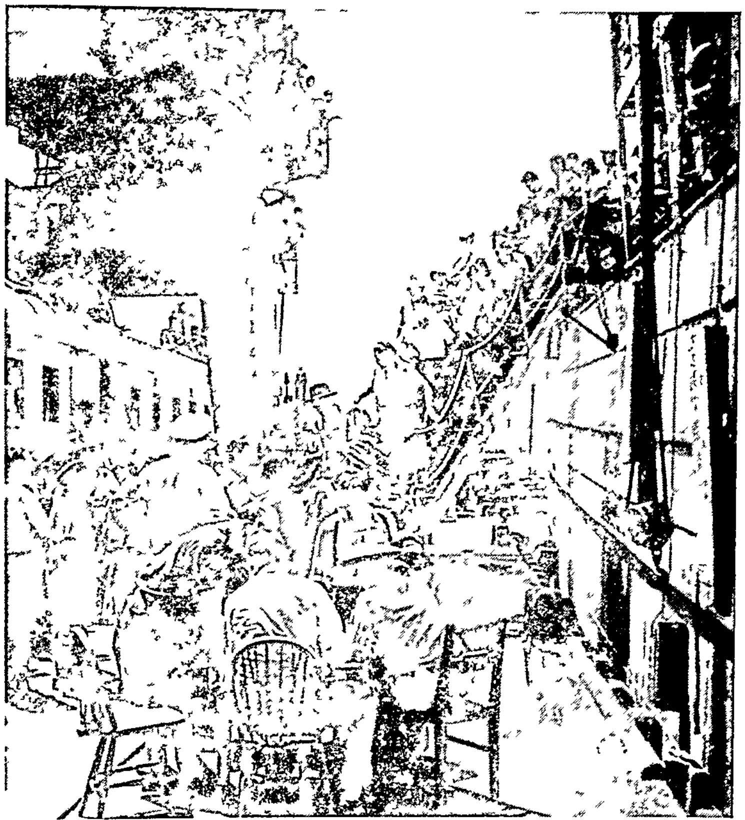
Finally, both plants and animals are said to migrate when they spread from one region to another by land or in the sea. Such migrations have taken place many times during past ages and are taking place today. During the Ice Age, for example, hairy mammoths spread from Asia to North America, crossing an isthmus now covered by the Bering Sea. Ground sloths and armadillos "migrated" northward from South America. Although ground sloths have died out, armadillos are still found in Mexico and Texas.

How MIGRATING PEOPLE *Have Made* HISTORY

MIGRATION OF PEOPLE. People enjoy traveling, but they are usually happy to return home. Being with family and friends and doing familiar things is the way most people like to live. Nevertheless, there are times when they are forced to leave home and migrate to another place, often another country and begin a new way of life.

Most people need deep and compelling reasons to uproot themselves and go elsewhere. To force them to move there must be both pressure at home and opportunity in another place. Paths to migration must be open; otherwise many people tend to endure what they have rather than to fight government or geographic barriers. The migrants themselves must have the strength to forsake home ties and to venture into a new and often strange environment.

Migration sometimes occurs in great surges, sometimes in a slow, thin stream. It may take place within the boundaries of one country or it may extend to distant lands. It differs from nomadic wanderings in being more permanent. Nomads drift about constantly and have no fixed home. The Plains Indians of America who followed the herds of bison were nomads. So were the shepherd tribes of the Asiatic grasslands. Some modern American nomads are the "migratory workers" who move from region to region, harvesting the various crops as they ripen. (*See also* Nomads.)



At a Haifa dock, officials and friends greet new immigrants to Israel. Israel's program of accepting virtually all Jews who wish admittance has resulted in one of the largest migratory movements of modern times.

True migrants leave one place to establish themselves in another. If permitted, they usually become citizens (or otherwise pledge themselves to loyalty) and they adopt the customs and habits of their new home. The millions of Europeans who settled in the United States were thus true migrants.

In ancient times migrating peoples generally followed the easiest natural routes. They traveled along coastal plains and river valleys rather than over mountains and through deserts. East to west has been the course of most of the great migrations of mankind. For many centuries the oceans barred mass migrations, and only the most adventurous dared sail out of the sight of land. The Polynesians were among the few ancient peoples who migrated across unknown waters to a new home.

If they can, migrants usually move into areas where the climate and other physical features are somewhat similar to those of their native lands. Many of the Scandinavian immigrants to the United States, for example, settled in Minnesota and Wisconsin, where adjustment to the new environment was relatively easy.

Migrating to Earn a Better Living

Within the United States today there is a steady shift of population. People move from farms to towns or cities and from one city to another. One proof of the shift is shown by the fact that communities in the Southwest and in the Pacific states are growing faster than the national average. Some people move there to find a more healthful climate, but most of the westward-moving migrants are seeking better job and business opportunities.

Most of man's migrations throughout history have been for economic reasons. In primitive times he moved to find more plentiful food. Today he seeks the opportunity to earn a better living. His quest has been fundamentally the same.

Nature itself has often forced him to economic migration. In glacial times the advancing icecap over northern Europe drove man southward (*see* Ice Age). Similar changes have occurred throughout history. They continue to occur today. Drought overtakes the land; ground water dries up; fields and pastures turn into dust bowls and deserts. Rivers swell into floods, washing away homes and the vital topsoil of croplands. Volcanoes erupt and spread devastating lava over communities and farms. From these natural catastrophes men must flee and find new places to earn livings for themselves and their families.

The migrations which took primitive men from their first homes and scattered them widely were doubtless set in motion by a series of such natural forces. Prehistoric men, who probably arose somewhere in central Asia, wandered westward. Groups of them settled in the fertile valleys of the Nile and of the Tigris and the Euphrates. In time many of their communities

were conquered by great migrations of shepherd people from the grasslands of the Caspian Sea. These conquerors are now called the Indo-European people, because their descendants largely populated both India and Europe. From their Asia Minor home, these people migrated in many directions.

One group of tribes swept southwest to the plateau of Iran, founding the great empire of the Medes and the Persians. Another group advanced into the Greek peninsula and later still another into Italy. Indo-Europeans spread northward over the plains of Russia, around the Baltic, and into the Danube Valley.

Always the ancient migratory people were seeking new hunting grounds, new pastures for their flocks, or new croplands. Sometimes they found them where no man had set foot before; sometimes they took them by force from the settled inhabitants. As the known world filled with people, force became the rule. Men seeking more fertile and prosperous lands could get them only by conquest. The Huns from Asia made inroads into eastern and central Europe, pushing out the Goths, Vandals, Franks, and other tribes. These barbaric people in turn descended upon the civilized but weak Roman Empire and virtually destroyed it. For a thousand years there was little or no migration in Europe.

Then came the discovery of America and a whole New World awaited migration and settlement. The land was only thinly populated by Indians who themselves had migrated from Asia centuries before. The first Europeans who came to America were not true migrants. Most of the Spanish and French voyagers of the 1500's came to win a fortune and then go home. Only later, when the population of Europe began to expand rapidly, did migrants come in great numbers to stay. European overpopulation, with its unemployment, scarcities, and even famine, sent huge numbers of immigrants across the sea.

The westward expansion of America itself came partly through this same search for opportunity and partly through an indefinable restlessness and hunger for newness. The West beckoned with a promise of opportunity and freedom unknown in Europe and already diminishing in the crowded cities of the eastern seaboard. In 1849 the prospect of acquiring sudden wealth in California gold spurred the growing number of western migrants in the United States. Less dazzling, but with the promise of greater security, were the grants of free land in the western territories. Hunters, trappers, and then cattle and sheep ranchers, farmers, and finally oil prospectors led the westward migration.

The United States has not been the only land of opportunity for overcrowded Europe. The countries of Britain's colonial empire, notably Canada and Australia, have given new homes to Britons and others. In South Africa, Europeans have found opportunity in a wealth of natural resources. Millions of Chinese and Japanese have migrated from their native lands to other Asiatic countries and to the Americas. In recent decades stricter quotas on both immigration and emigration have slowed the streams of these international movements (*see* Immigration).

Migration to Freedom

Many times throughout history groups of people have been forced to momentous choices by their governments: stay, and give up deeply felt beliefs and convictions; or leave. Often they have taken the latter choice. Rather than disavow their cherished ideals, they have chosen to migrate to another country where they could live without compromise.

The exodus of the Hebrews from Egypt, their land of bondage, is a noted Biblical example of such migration. In the late 1400's Moors and Jews who would not accept Christianity were expelled from Spain. The Pilgrims who landed on Plymouth Rock in 1620 were seeking freedom to worship in their own way (*see* 'Mayflower'). The Quakers who settled in Pennsylvania were also fleeing government control of religious beliefs. The Mormons migrated westward until they could establish their church without persecution from their neighbors (*see* Mormons). In 1848 the failure of a large group of freedom-loving Germans to establish democracy in their land sent many of them as migrants to the United States. Indeed among the millions of immigrants to the United States many have sought not only economic opportunity but the freedom of political and religious belief denied them at home.

The rise of totalitarian states in Europe created new problems in migration. Governments barred passage out of their countries, and only the most resourceful could escape. At the same time, within national boundaries some governments removed people from their homes and sent them to work in state-controlled mines and factories. These same governments annexed weaker neighboring countries and forced their people into similar migrations for state service.

The close of the second World War left millions of *displaced persons* homeless. Many of these disappeared into "iron curtain" countries, often against their will. Others were absorbed by western European countries and American nations. European Jews presented a special migration problem. More than 6 million had been killed in a relentless program of extermination. Most of the remainder ardently desired to live in a national homeland. The new state of Israel accepted all who wished to come and later similarly admitted Jewish refugees from North Africa and western Asia (*see* Israel).

Results of World Migration

People with the will to migrate have generally been energetic and enterprising. The ancient migrants from Asia into Europe were vigorous people who fused their new ways with established customs and thus quickened the development of civilization. Each successive wave of migration into a new land has done the same.

Migrants have conquered wildernesses, developed natural resources, and established nations. The history of the United States is largely the history of the migrants who settled it and whose descendants moved steadily westward to expand it.

MILAN (*mĭ-lăn'*), **ITALY.** Set in the heart of the fertile Po basin, on a main route of trade and transportation with western Europe, Milan long ago became a center of commerce and finance. In more recent times the vigor and ambition of its people built it into Italy's greatest industrial city. For this fact, the city paid a heavy price during the second World War. It was heavily bombed by Allied planes both before Italy's surrender and afterward when the Germans used it as a supply center.

These bombings added a new chapter to a long history of raids and invasions. The city started life as Mediolanum, a Gallic town, and was taken by the Romans in 222 B.C. It was sacked and burned once by the Huns, twice by the Goths, and once by the German emperor, Frederick Barbarossa in 1162.

After it was rebuilt, Milan suffered a century of civil strife. Then the house of Visconti gained control of the powerful city state. The last Visconti duke died in 1447 and three years later began the rule of the Sforzas, continuing to 1535. Most of the ancient beauty of the city was created by the heads of these two great houses. When the Sforza line died out, Spain seized Milan and held it until 1714. It then fell to Austria, which governed it until Napoleon created his shortlived Kingdom of Italy and made Milan its capital. After Napoleon's fall, Milan was restored to Austria. In 1859 it was included in the new united kingdom of Italy.

Art and Architecture

Because of the repeated ravages, Milan has almost no relics of Roman or medieval days; but the world-famous Milan Cathedral rises like a brilliant white crown above the heart of the city. Another great church is that of Sant' Ambrogio (St. Ambrose), built by this saint in the 4th century, but twice destroyed and rebuilt. Here St. Ambrose baptized St. Augustine, and here many early emperors and kings were crowned with the "iron crown" of Lombardy, so called from its iron circlet said to have been made of a nail from the crucifixion. Nearby stands the former convent of Santa Maria delle Grazie, where Leonardo da Vinci's famous painting 'The Last Supper' appears on the refectory wall.

The artistic and literary life of Milan centers about the Brera Palace, the home of the Academy of Fine Arts and Science. Its fine picture gallery contains paintings by Raphael, Titian, Van Dyck, Veronese, Tintoretto, Bellini, Carpacio, and many other great artists. In addition to this academy the city also has two famous libraries, a university, a school of commerce and agriculture, a fine academy of music, and a celebrated archeological museum.

La Scala, its world-renowned opera house, was severely damaged by air raids in 1943, but was repaired at the war's end to bring the Milanese the music they love. Another building struck by bombs was the Galleria Vittorio Emmanuele, a great arcade in the form of a cross, lined with smart shops. The octagon at its center was crowned with a glass cupola 160 feet high and the streets that passed through it were roofed with glass.

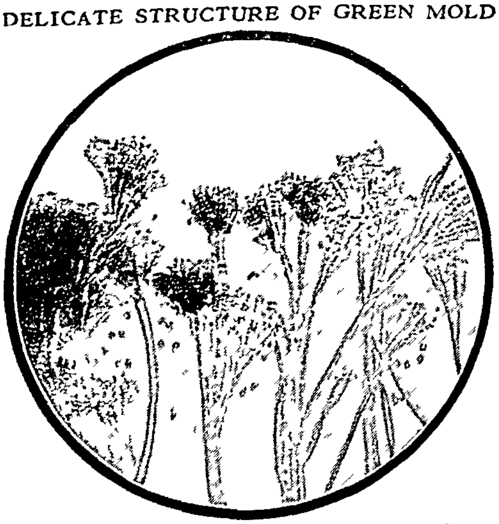
Commercial and Industrial Growth

As Italy's greatest railway center, Milan commands lines crossing the Alps via the Simplon and St. Gothard passes, and others leading east to Venice, and south to Genoa and peninsular Italy. Coal shipped from western Europe and electricity from Alpine waterfalls furnish power for its industries. It is one of the world's leading cities in the manufacture of textiles, especially silks and rayons. Other important manufactures are locomotives, turbines, bridges, railway trucks, boilers, motors, pumps, rubber goods, surgical and musical instruments, dynamos, bicycles, automobiles, furniture, chocolate, and chemicals. Fine jewelry and art wares are created by artisans who work in their homes.

As commerce and industry increased in the period between the two World Wars, the Milanese modernized their city greatly. They built a huge new railroad station and an airport, and added wider streets and taller buildings. In population the city overtook all but Rome and led all others by a substantial margin. Population (1951 census, preliminary), 1,264,402.

MILDEWS AND MOLDS. We frequently find small downy or velvety patches called mildew or mold on the surface of leaves, fruit, damp cloth, moist foodstuffs, etc. Sometimes the growth covers a large area, with a film of soft cottony tissue, very thin. By using a powerful magnifying glass we can see that the growth is composed of a great number of tiny plants, so small that separately they cannot be seen by the naked eye. If we use a compound microscope we can see the structure of these tiny plants, and we discover that their thread-like bodies cover the surface on which they grow with a network of delicate cobweb-like strands or filaments.

DELICATE STRUCTURE OF GREEN MOLD



This green mold (*Penicillium glaucum*), shown highly magnified, grows on bread and other foods. Its cousin from the soil (*Penicillium notatum*) secretes penicillin (*see* Antiseptics).

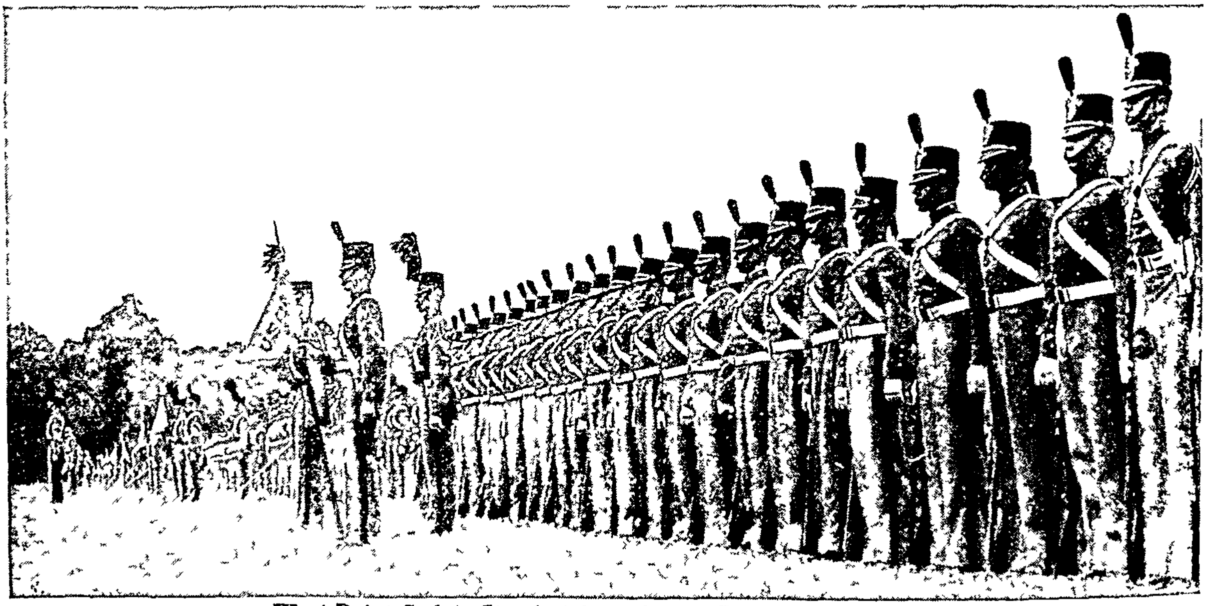
Mildews and molds are one of the divisions of the *fungi*, which include toadstools, mushrooms, and many microscopic plants. Like all fungi, they are either parasites, living upon the bodies of other plants larger than themselves, or saprophytes, living upon dead vegetable and animal matter.

"Downy mildews" usually grow within the tissues or cells of plants, and thus do a great deal of harm to the stems and leaves, drying them up and making them curl and twist. One of the best known of these is the grape mildew, the larger part of whose thread-like body grows within the grape leaf, and sends out upon the surface masses of fibers which appear to the naked eye as small white patches. These patches generate tiny spores, invisible to the naked eye, which are carried by the wind to other leaves where they take root and grow into new mildew plants.

Powdery mildew can be removed from plants by dusting them with sulphur powder, or spraying them with a fungicide (*see* Spraying and Fumigating). The spores of green and black mold exist in the air almost everywhere. That is why damp bread and other food left standing in kitchens will almost always become covered with a furry green coat. To protect food from these molds, it should be kept in dry airy places. (*See also* Fungi; Rusts and Smuts.)

Scientific name of true mildews, *Ascomycetes;* false or downy mildews and black molds belong to the *Phycomycetes.*

WHERE *the* ARMY TRAINS *Its* OFFICERS



West Point Cadets Stand at Attention for Inspection and Review

MILITARY ACADEMY, UNITED STATES. Each June a stirring review is held on the wooded bluffs of the Hudson River at West Point, N. Y. It is graduation day for the United States Military Academy.

Companies of cadets march smartly out to the parade ground. Their spotless gray and white uniforms are studded with shining brass and topped with high "tarbucket" hats. "Dressed" into precise lines, the men stand rigidly at attention during the ceremony. Then snapping their rifles to "right shoulder arms" the ranks wheel and march past the reviewing stand. The cadets move in perfect step, every eye looks straight ahead, every free hand swings in unison.

This amazing precision is not merely for display. These young men are being trained to obey commands exactly so that later they can give commands exactly. They are learning to strive for perfection in every detail of duty. They are training to become officers in the United States Army.

Cadet Life at West Point

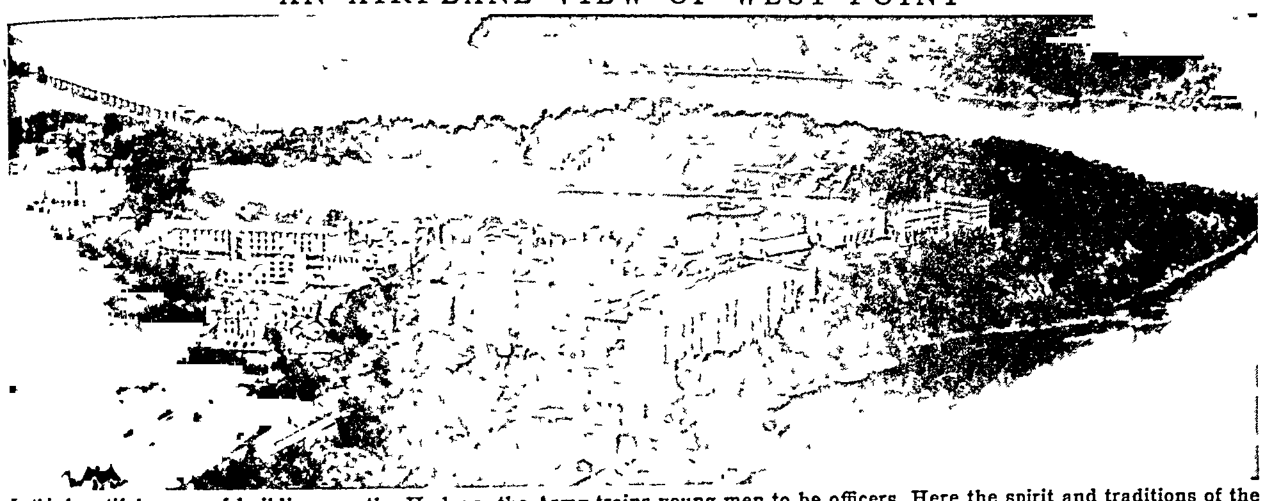
The training begins the instant a young man reports for duty on the first Tuesday in July. He and a roommate are assigned a bare, pictureless room in the barracks. Promptly he begins two months of drills and exercises that prepare him for the work to come. On the morning after Labor Day, the cadet starts his schooling.

First-year cadets, known as fourth classmen, or "plebes," study mathematics, military topography and graphics (covering map making and surveying), tactics, English, and a foreign language. Second-year men (third classmen, or "yearlings") add physics, chemistry, psychology, and military hygiene to the schedule. Cadets in their third year (second classmen) take mechanics, electricity, tactics, military psychology and leadership, history, government, and geography. Fourth-year cadets (first classmen) study military art and engineering, economics and international relations, English, law, tactics, ordnance, military psychology and leadership, and military hygiene.

Cadets have leaves, or vacations, during the summer, as follows: first class, three weeks; second class, four weeks; third class, four weeks. They devote the rest of the summer to practical military instruction, including combat training at Camp Buckner and aviation training at Stewart Field.

At the end of four years, cadets who have met all the high requirements are graduated with the degree

AN AIRPLANE VIEW OF WEST POINT



In this beautiful group of buildings on the Hudson, the Army trains young men to be officers. Here the spirit and traditions of the military service are impressed indelibly upon the cadets, and they spread the spirit of West Point throughout the service.

of bachelor of science. Most of them are commissioned second lieutenants in the Regular Army. The others receive commissions in the Air Force.

West Point is directed and supervised by the Department of the Army. In 1942 an act of Congress established the normal number of cadets as 2,496. Graduation creates about 750 vacancies every year. The president makes appointments to the vacancies on receipt of nominations from authorized sources. These sources and the number of appointments they control are as follows: vice-president of the United States, 3; United States senators, 4 each; representatives in Congress, 4 each; Alaskan delegate in Congress, 4; Hawaiian delegate, 4; commissioners of the District of Columbia, 6; resident commissioner of Puerto Rico, 4; governor of the Panama Canal Zone, 2; Army and Air Force, 180; the president, 89 sons of members of the armed forces; Veterans Administration, 40 sons of men killed in the first or second World War; honor military schools, 40. In addition, the Department of the Army may appoint any qualified son of a winner of the Congressional Medal of Honor. The president may appoint 20 cadets from Latin American republics and Canada, and the secretary of the Army may appoint one Filipino each year.

All applicants must pass physical and mental aptitude tests. Unless they have had one semester of work at college level they must also pass achievement tests in English and mathematics. For about 86 per cent, entrance examinations are noncompetitive. But members of the armed forces or their sons and applicants from honor military schools receive appointments on the basis of competitive examinations.

All applicants must be single, between 17 and 22 years old, and at least 5 feet 6 inches but not over 6 feet 4 inches tall. They agree to serve in the Army three consecutive years after graduation.

Cadets receive $78 a month throughout their four years at West Point. Out of this they pay for their clothes and books.

West Point is on the Hudson River about 52 miles north of New York City. The Polish patriot and engineer, Thaddeus Kosciusko, helped to fortify the site during the American Revolution. Fort Putnam and Fort Clinton date back to this period.

An act of Congress founded the United States Military Academy at West Point in 1802. The Academy owes many of its finest traditions to Col. Sylvanus Thayer, its superintendent from 1817 to 1833. Colonel Thayer developed the system of building character while providing broad professional training.

Academy graduates have served with distinction in every war fought by the United States, beginning with the War of 1812. In the Civil War the opposing commanders, Grant and Lee, were both West Point graduates. About 8,800 West Pointers saw service during the second World War.

A CADET'S DAY AT WEST POINT

5:50 A.M.—The reveille gun, bugle, and drums.

6:20—Police call. Cadets must sweep their own rooms, fold their bedding, and leave everything exactly in prescribed order.

6:30—March in ranks to breakfast.

7:15—Call to quarters. Cadets remain in their rooms to study when not attending classes. Classes and study periods alternate from 7:55 until the march to dinner at 12 o'clock. They resume after dinner and last until 3 o'clock.

3:15 P.M.—Drills alternating with supervised athletics. These activities vary according to classes and seasons. The drills include handling the weapons and equipment of every branch of the service, tactical exercises and maneuvers, target practise, field engineering, and building temporary bridges and other structures. Other activities include riding, fencing, boxing, wrestling, swimming, ice skating, and gymnastics, and the essentials of such games as football, baseball, lacrosse, tennis, and basketball.

4:15—Recall from drill.

4.45—Parade. After parade, at 6:20, the cadets march to supper; half an hour after supper the evening study period begins, lasting until 9:30.

9:30—Tattoo (prepare for bed).

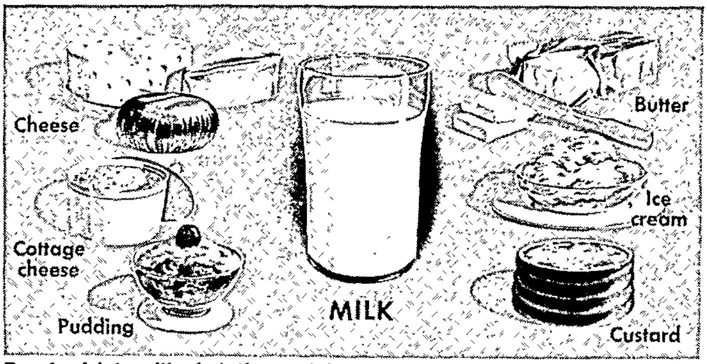
10.00—Taps (lights out; inspection).

MILK *and Its* PRODUCTS—*Our* BASIC FOODS

MILK. The most nearly perfect food in the world is milk. Babies get their start in life by drinking milk. So do the young of all the four-footed, warm-blooded animals. Milk gives them the nourishment they need for health and growth. It is nature's food. Each mother provides it for her own baby.

Man learned long ago that if he fed certain animals generously they would give more milk than their young could use. He took advantage of this fact to get milk for himself. Fresh milk soured rapidly, and so he learned to make it into cheese, cottage cheese, butter, and other foods which keep longer.

THESE ARE AMONG OUR FINEST FOODS



People drink milk, but they eat it too, as this picture shows. Cheese, cottage cheese, and butter are foods made entirely of milk. Ice cream, custard, and many puddings contain milk as an important ingredient.

People use the milk of animals that thrive in their homelands. Reindeer, caribou, camels, mares, water buffaloes, sheep, and goats have all provided milk for human beings. Cows, however, are the best milk producers. If they are fed well and have good care, they give several times their weight in milk every year. They provide practically all the milk used in English-speaking countries and in western Europe.

Why Milk Is a Basic Food

Cow's milk contains some of all the basic food materials that give people energy and help them grow strong and healthy. It is a rich source of minerals and vitamins. It is easy for most people to digest.

About three fourths of the calcium in the food eaten by people in the United States is in milk. This mineral helps build straight strong bones and sound teeth. It makes milk especially important to young children as well as to growing boys and girls.

Milk also contains almost half the riboflavin (a vitamin B) in the national food supply, and butter is the commonest source of vitamin A. These two vitamins are necessary to health all during life.

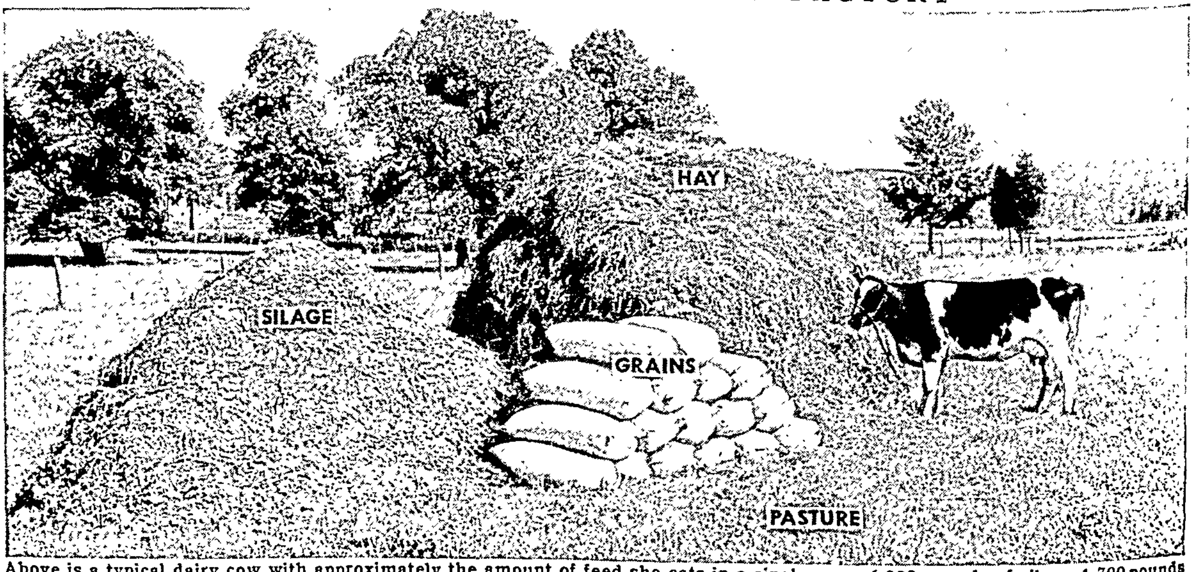
Cow's milk is an *almost* perfect food. But even in large quantities it would not supply quite all the food materials human beings need. More iron, vitamins, and bulk, or roughage, than milk contains are necessary for good health.

How Cows Make Milk from Grass and Grain

Cows make very efficient "milk factories" for human beings. They eat coarse foods, such as grass, clover, and chopped corn stalks, which we cannot eat or digest. After digesting this food, they use part of it as nourishment for themselves and turn part of it into milk.

The cow has a special kind of stomach which makes it possible for her to digest large quantities of coarse food. Instead of one stomach, or stomach bag,

THE DAIRY COW IS OUR "MILK FACTORY"



Above is a typical dairy cow with approximately the amount of feed she eats in a single year: 6,300 pounds of silage, 1,700 pounds of grains, 2,730 pounds of hay, and grass from two acres of pasture. She drinks 11½ tons of water a year, or about 8 gallons a day. She weighs 1,000 pounds and gives more than seven times her weight in milk a year—7,605 pounds.

she has four. When she is eating, she chews her food just enough so that she can swallow it. Swallowing carries food into the first stomach, the *rumen*. This is a reservoir where the cow keeps food until she has eaten enough to satisfy her hunger. It holds as much as 50 gallons and is never quite empty. It is divided into four sacs with muscular walls. The muscles churn the food back and forth from one sac to another to soften it and break it up. In the meantime the food is fermenting. (*See also* Ruminants.)

When a cow has finished eating, she begins to *ruminate*, or chew her cud. She brings softened food up from the rumen in small quantities and chews it thoroughly. Each cud requires about 50 seconds of chewing. Cows spend about seven hours every day ruminating The well-chewed food passes through the second and third stomachs for further grinding and softening. True digestion takes place in the fourth stomach, the only one with digestive juices. It continues in the intestines. The long digestive process turns coarse, tough, fibrous food into a solution which the blood can absorb from the intestines and carry away to other parts of the body.

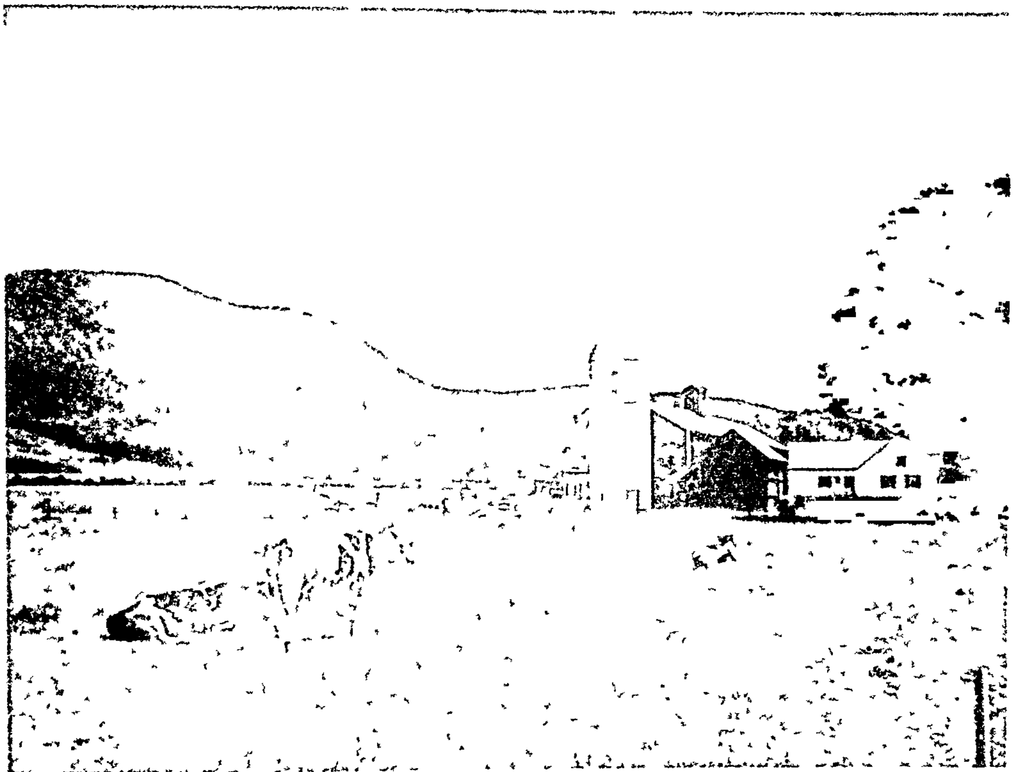
Work of the Milk Glands

Shortly before a cow is ready to give birth to a calf, her blood carries dissolved food to her udder. The udder is a milk sac consisting of two milk glands. It has four compartments, each with its own outlet, the teat, or nipple. The milk glands manufacture milk from the food the blood stream brings to them.

Nature intended the cow to produce enough milk to feed her calf for several months. The calf would then be old enough to eat solid food, and its mother's milk would dry up. But with plenty of food, good care, and regular milking, cows will go on making milk until six or eight weeks before they are ready to give birth to another calf. Then they "dry off." When they give milk again, after the new calf is born, they are said to "freshen."

Farmers usually take calves from their mothers one to five days after birth. They teach them to drink milk, skimmed milk, or gruel, often from a pail equipped with a rubber nipple. Soon the calves are also given hay and grain. They may be able to get along without milk in about two months. In the meantime the mother cows are being milked regularly and their milk used by the farm family or sold.

SUMMER ON A DAIRY FARM



This picture shows the four buildings which are essential on all dairy farms a home for the farmer and his family, a barn for the cows, a silo for storing winter feed, and a milk house

Milk Production on Dairy Farms

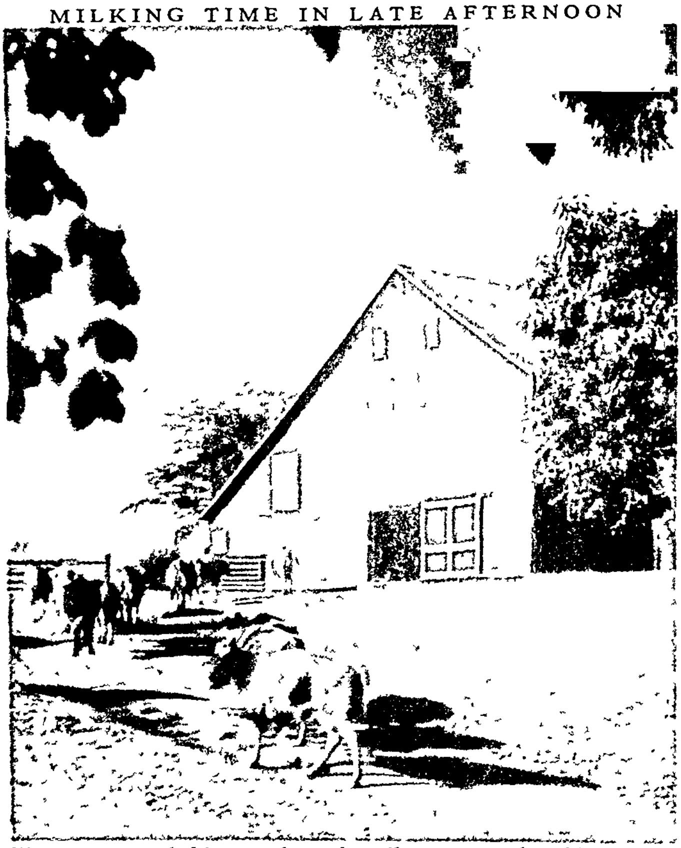
FARMS where cows are raised especially for their milk are called dairy farms. There are so many farms of this kind in the northern part of the United States from New England and New York to Minnesota and Iowa that the area is known as the "dairy belt." Southeastern Canada has a similar dairy belt. The climate of these areas is good for milk cows. American breeds of cattle have no sweat glands in their skin to cool them, and so they are healthier if the summers are short. The climate and soil together make it possible for farmers to have fine pastures and to raise many kinds of feed for their cows.

There are smaller dairy regions close to almost all the large cities of the United States. They supply fresh milk for the people in these cities. And every part of the country has many farms which are not dairy farms but which have one or two cows to provide milk for the farm family. In all, there are more than 24,500,000 milk cows in the United States. (*See also* Farm Life; Agriculture.)

What a Dairy Farm Is Like

A typical dairy farmer may have 30 or more cows. Each cow needs two acres of pasture for summer feeding. The farmer usually owns about two more acres for each cow in his herd. On this land he raises hay, corn, oats, or other kinds of feed. The farm has at

MILKING TIME IN LATE AFTERNOON



These cows are glad to come home from the pasture to be milked. They become uncomfortable if they go too long without milking.

least four buildings: the farmer's home, a barn, a silo, and a milk house.

Most barns are two stories high. The upper story serves as a loft for storing hay, grain, and straw. The first floor may be divided into stalls. In this case each cow has her own stall, where she eats, sleeps, and is milked. Aisles between the stalls make it easy for the farmer to carry feed to the cows, to clean their stalls, and to milk them.

A COMFORTABLE HOME FOR COWS

Every cow in this barn has her own stall, with its feed box and straw bedding. She also has plenty of light and air.

Many modern barns have a "loafing shed" and a "milking parlor" instead of individual stalls. The loafing shed is a large space without partitions in which the cows can move around and lie down where they please. The milking parlor is a separate room for milking.

The farmer spreads fresh straw in the stalls or loafing shed every day to give his cows bedding. Each cow has her own manger or feeding trough. She may have her own mechanical drinking cup too. Water bubbles up like water in a drinking fountain when the cow starts to drink and presses her nose or mouth against a valve on the inside of the cup.

The silo is a high, round building close to the barn. Here the farmer stores winter feed such as chopped green stalks and ears of corn, alfalfa, and clover. He may harvest these feeds with a "forage harvester," which also does the chopping, and then blows the feed up into the silo through a pipe. (*See also* Silo.)

The milk house is the third essential work building on a dairy farm. It contains a cooler, or big refrigerator, for storing milk temporarily and a place where the farmer can wash and sterilize his milking equipment.

Clean healthy cows and clean equipment are very important because they help make safe milk possible. The floors of modern barns and milk houses are built of concrete or some other material which is easy to keep clean. The walls and ceilings have a smooth finish to which dirt will not cling. The screens may be electrically wired as an extra precaution to keep out flies.

Veterinarians examine the cows frequently to make certain they are healthy. All dairy cows in the United States are tested regularly for tuberculosis. In most regions they are also tested for mastitis, an inflammation of the udder, and for Bang's disease, which is similar to brucellosis, or undulant fever, in human beings. The United States Department of Agriculture and state agricultural experiment stations have experts the farmer can consult about his herd. The milk company which buys his milk may send inspectors to his farm to examine his cows and to see whether he keeps his equipment clean.

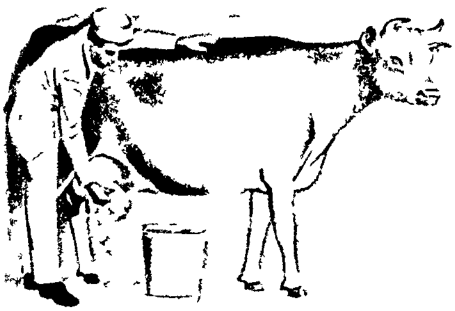
Kindness on the part of the farmer and his helpers is important in the successful management of a dairy herd. Cows are gentle, patient, and friendly. They do not like rough handling, and their milk may dry up if they are nervous.

Cows are milked at least twice a day, usually at five or six in the morning and at the same hour in the evening. Milking used to be done by hand. Today electric milking machines are standard equipment on up-to-date dairy farms.

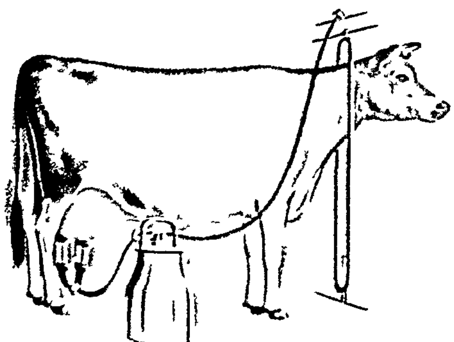
The pictures on the next page show some of the tasks that make up a day's work on a dairy farm.

PART OF THE DAY'S WORK ON A DAIRY FARM

1 A veterinarian tests each cow frequently to make sure that she is healthy and gives good milk

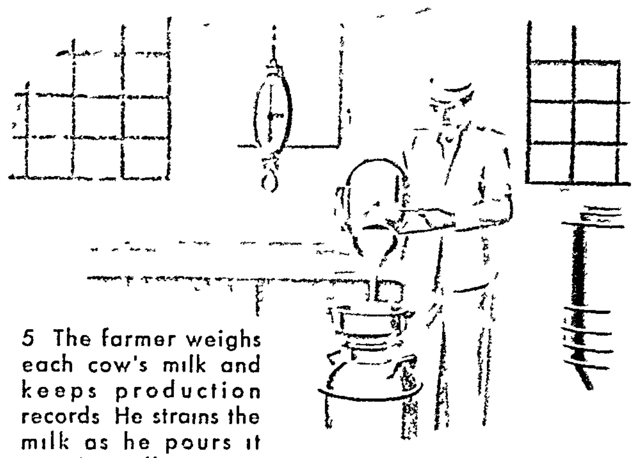


2 The farmer washes the cow's udder carefully before milking.

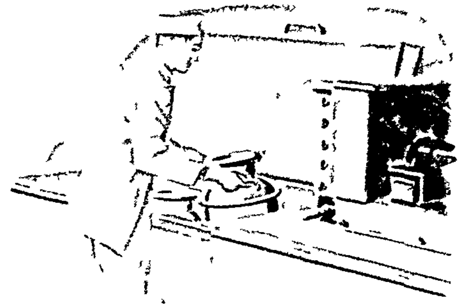


3 Electric milking machines do the milking on large dairy farms A stanchion, or head frame, keeps the cow from moving away.

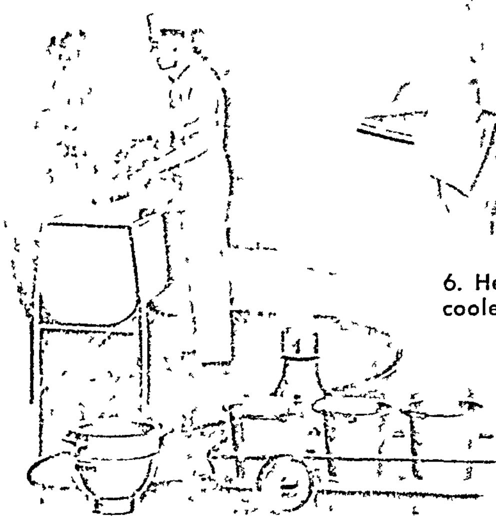
4 The farmer finishes milking by hand to get all the milk This procedure is called "stripping"



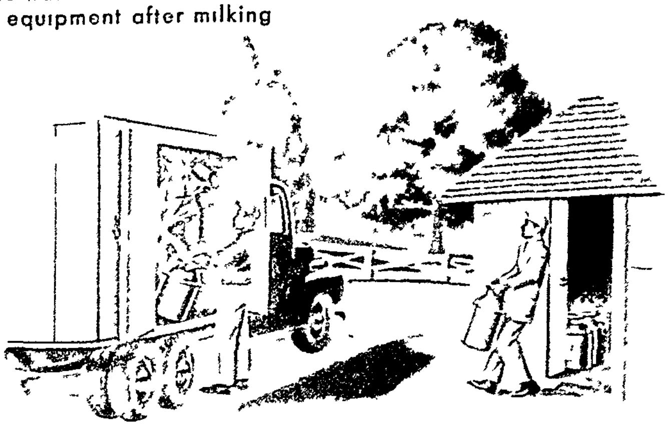
5 The farmer weighs each cow's milk and keeps production records He strains the milk as he pours it into 10-gallon cans



6. He puts the big cans into a cooler to keep the milk fresh



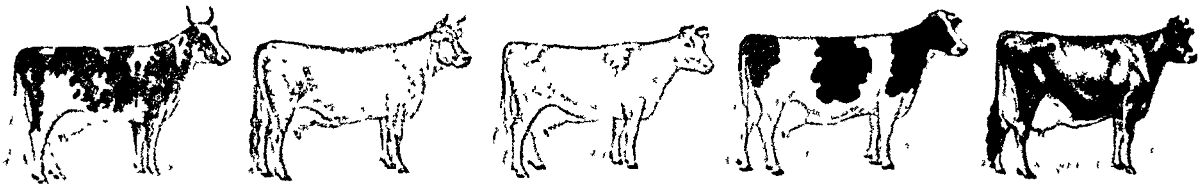
7. He washes and sterilizes all the equipment after milking



8 Once a day a truck from a country milk station or a dairy plant picks up the cans of cool, sweet milk.

The cow has to be healthy and her surroundings clean if she is to provide wholesome, nourishing milk. These pictures illustrate the care which good dairy farmers take in managing their cows, handling the milk, and cleaning the equipment. One precaution is to provide clean, washable clothing and caps for men who work in the barn and milk house.

THE FIVE MOST POPULAR BREEDS OF DAIRY COWS



AYRSHIRE BROWN SWISS GUERNSEY HOLSTEIN-FRIESIAN JERSEY

Each of these breeds is considered "best" by many farmers. The Holstein-Friesian ranks first and the Brown Swiss second in amount of milk. The Jersey gives the richest milk and the Guernsey the next richest. The Ayrshire is sturdy and gives average milk.

Milk at the Dairy Plant

MILK goes from the farm to a dairy plant to be processed and to be put into bottles and cartons for delivery to homes, stores, restaurants, hotels, hospitals, and other institutions. The milk has to be handled rapidly and kept cold so that it will not spoil.

A farmer may sell his milk to a dairy plant within 50 miles of his farm. If he does, he sends it there in 10-gallon cans by truck. He may sell it to a plant farther away. In this case he sends it to a country receiving station. This milk station serves as a collection center for milk from many farms. Workers at the station weigh the milk from each farm, test it, chill it, and send it on to city dairy plants in tank trucks or railway tank cars.

A tank truck or car is constructed on the inside like a big Thermos bottle lying lengthwise. The lining is stainless steel or glass. The largest trucks hold more than 4,000 gallons. Railway cars usually have two tanks, each with a capacity of 3,000 gallons. The trucks travel swiftly, and the cars go by fast freight. Both trucks and cars can carry milk hundreds of miles without its varying more than a few degrees in temperature.

Workers at the country receiving station or at the city dairy plant test samples of milk from each farm. One test is for butterfat. This is the natural fat of milk. It consists of globules, or little balls of fat, so small they cannot be seen except through a microscope. Butterfat is light and rises to the top of milk when it stands, making cream. It turns into butter when milk is churned. The percentage of butterfat in milk helps determine how much money a farmer is paid for his milk.

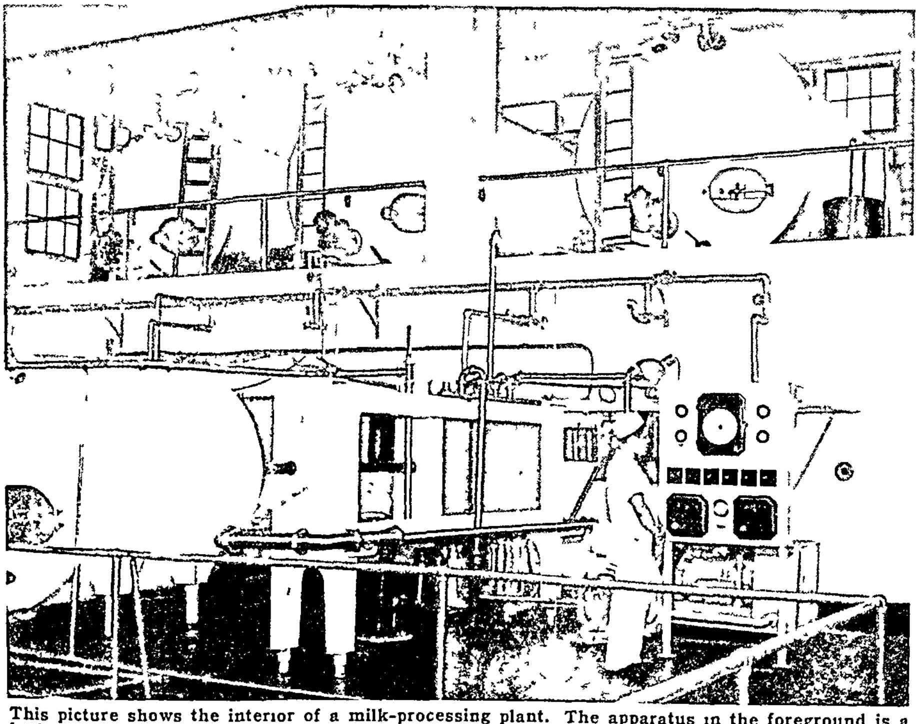
Another test of milk is for bacteria. Milk always contains some of these before being processed. But if it contains too many, workers at the dairy plant know that conditions under which it was produced or shipped were not sanitary.

When milk reaches the dairy plant it flows through coolers into refrigerated temporary-holding tanks. It may stay in these tanks until the day's supply has been received. Then it makes a trip through sterile pipes to a bottling machine, with stopovers in various other machines for processing.

The first stopover is in a *clarifier*, or filter. The second may be in a *homogenizer*. This machine contains many tiny holes through which the milk is forced under high pressure. The process breaks butterfat globules into particles so fine they will not rise to the top as cream. Not everyone likes homogenized milk; so not all the milk is routed through the homogenizer.

The next stop is in a pasteurizer. Pasteurization kills harmful bacteria with heat. There are two kinds of pasteurizers. One heats milk to at least 143° F. for

PASTEURIZATION FOR SAFETY



This picture shows the interior of a milk-processing plant. The apparatus in the foreground is a high-temperature, short-time pasteurizer. It heats the milk to 160° F. for at least 15 seconds. The big cylindrical containers are temporary-holding tanks.

30 minutes. The other heats milk to 160° F. for about 15 seconds. Pasteurization makes milk safe to drink. It does not make milk less nourishing. Many communities require pasteurization of all milk that is sold commercially.

Next milk flows through a *cooler* to be chilled. Then it is ready for bottling. The bottles are scrubbed in a washing machine for about half an hour and then sterilized. An inspector puts them on a moving rack like a conveyor belt. The rack carries them under a machine which fills each bottle to the brim and quickly seals it with a cap.

A USEFUL NANNY GOAT

The milking stand shown here makes it easy for the farmer to milk his goat by hand. Large goat farms may have electric milking machines similar to those used in milking cows.

Cartons for milk are made of heavy paper, sterilized, and covered with hot paraffin to make them leakproof. A machine similar to the bottling machine fills and seals them. Filled bottles and cartons go to a refrigerated room to remain until delivery men pick them up. These are the "milkmen." They take milk on the last lap of its journey from farms to homes, stores, and institutions.

Every day workers in the dairy plant take down all the piping that carries milk. They wash and sterilize the piping and all the machines. About one third of the labor time may be spent in cleaning equipment.

A dairy company may separate cream from whole milk and bottle it at the milk-processing plant. Or it may separate the cream at one plant and ship it to the milk plant for pasteurization. Milk left after the cream has been removed is *skimmed milk*. The dairy may sell this for cattle feed, convert it into powdered skimmed milk, or bottle it for sale as liquid skimmed milk.

Dairies also make butter, ice cream, cottage cheese, and flavored milk drinks. (*See also* Dairying; Butter; Cheese; Ice Cream.)

Milk around the World

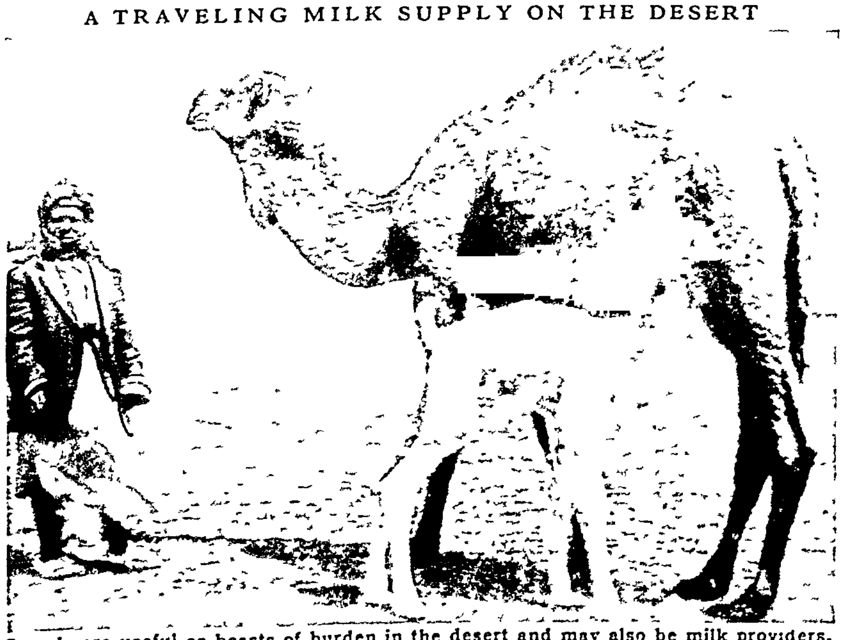
THE United States produces more milk than any other country. But the people of Sweden drink more milk. They average about three fifths of a quart a day. The people of the United States average about a pint.

In great Britain, the people drink about 60 per cent of the milk produced. Australia, on the other hand, converts 80 per cent of its milk into butter. Other great butter producers are New Zealand, Denmark, Canada, the Netherlands, and Sweden. Italy uses more than 25 per cent of its milk supply to make cheese. This is the highest percentage for any country.

The people of various countries use the milk of other animals in addition to cow's milk. In Turkey, Italy, Greece, and Egypt, for example, they use the milk of sheep, goats, and water buffaloes; in India and Pakistan, the milk of goats and water buffaloes, and in Switzerland, Japan, and Mexico, that of goats, They usually use the milk of sheep and water buffaloes to make cheese. Goat's milk is becoming increasingly popular in the United States.

The use of milk in any region depends on its availability and on custom. These two factors may be interdependent. If there has never been a supply of fresh, pure milk available, the people may traditionally regard all milk as being unfit for human consumption. This is the situation in some of the less modernized parts of China, Burma, and Japan.

A TRAVELING MILK SUPPLY ON THE DESERT



Camels are useful as beasts of burden in the desert and may also be milk providers. The mother above is feeding her own baby. The man standing at the left may later take some of her milk for himself.

WHAT DOES THE LABEL MEAN?

FRESH MILK	Raw milk is milk as it comes from the cow. The United States Public Service Milk Code states that it must contain at least 8 per cent milk solids other than fat and 3.25 per cent milk fat. Pasteurized milk means safe milk. It has been heated to kill bacteria that might cause disease. Homogenized milk has been especially treated so that the cream will not rise. Certified milk is produced with extra attention to nutrition of the cows and to sanitary production. The American Association of Medical Milk Commissions sets the standards. The milk is usually pasteurized. Skimmed milk has had the butterfat (which includes the vitamin A content) removed. Soft curd milk has had the mineral content so changed by mechanical means, such as special filtering, that the milk remains almost fluid during digestion.
CULTURED MILK	Cultured milk has been fermented by harmless bacteria which produce lactic acid during the process. The bacteria may be allowed to develop naturally or may be cultivated ("cultured") artificially and then introduced into the milk. The milk has the same food value it had before souring; it may be slightly more digestible to persons with delicate digestive systems. Sour milk has been fermented by lactic acid bacilli. Buttermilk is the milk left after buttermaking or fat-free milk soured by lactic acid bacilli. Acidophilus milk has been fermented by the strain called *Lactobacillus acidophilus*. Yogurt is milk fermented chiefly by *Lactobacillus bulgaricus*.
CONCENTRATED MILK	Evaporated milk is homogenized whole milk with about 60 per cent of its water removed by heating in a vacuum cooker. Its food value is about the same as that of fresh whole milk. Sweetened condensed milk is evaporated milk with about 40 per cent sugar added. Dry milk is milk evaporated to a powder. Whole milk powder has had only the water removed. Nonfat milk solids have had both water and fat removed. Concentrated liquid milk is fresh, whole, homogenized milk with two thirds of the water removed. It is processed at a lower temperature than evaporated milk. It must be kept refrigerated.
CREAM	Light cream contains 18–30 per cent butterfat. It may also be called coffee cream or table cream. Whipping cream is either light (30–36 per cent butterfat) or heavy (36 per cent or more butterfat). Half-and-half has about 10–12 per cent butterfat. Sour cream is cultured homogenized cream ripened until it is thick, smooth, and pleasant tasting.

This chart tells what dairy companies mean by most of the labels they put on bottled or packaged milk and cream. Some communities have local standards by which they grade milk. These standards concern cleanliness during production and the bacterial count of the milk. Usually Grade A signifies the best and Grade B the second best according to these standards.

Food Value of Milk and Its Chief Products

MILK contains the three basic food materials that human beings need: protein, carbohydrate, and fat. In addition, it has important minerals and vitamins. Milk averages about 87 per cent water. The remaining 13 per cent, called *milk solids*, contains all the nourishment.

The chief protein of milk is *casein*. This is an animal protein of high quality. It forms the curd that becomes cheese. Cottage cheese, which is made by curdling skimmed milk with a culture of harmless bacteria, is mostly casein. There are minor proteins which go into the whey, the watery part formed when milk thickens into a curd.

The carbohydrate in milk is an easily digested sugar called *lactose*. Like all carbohydrates, it is an energy maker. Cheese does not contain lactose. It drains off in the whey.

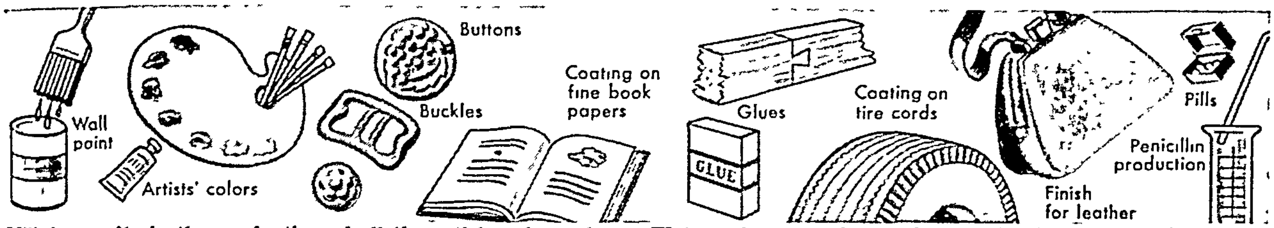
Fats yield more than twice as much energy (or twice as many calories) for each unit of weight as carbohydrates and protein. Butterfat, therefore, makes an excellent source of energy. Butter is about 81 per cent fat. The rest of its bulk consists of moisture, curd, and salt. Cheese as a rule does not contain much fat. Creamed cheese and creamed cottage cheese are exceptions, for cream has been added to them.

Calcium and phosphorus combine to form the chief mineral contribution of milk. The body needs phosphorus chiefly for building good bones and teeth and to help it make use of calcium. One ounce of cheddar-type cheese, 4 ounces of cream-type cheese, or 12 ounces of cottage cheese have about the same amount of calcium as 8 ounces, or one glass, of milk.

The major vitamin contribution of milk consists of vitamin A, present in butterfat; three members of the vitamin B complex—thiamine, riboflavin, and niacin; and vitamin C. Milk labeled "Vitamin D Milk" has 400 units of this vitamin added for each quart.

Pasteurization does not significantly affect any of the nutrients in milk except vitamin C and thiamine. Processing reduces the amount of these two vitamins from 3 to 20 per cent. The loss is smallest with

MILK PROTEIN AND MILK SUGAR HAVE A VARIETY OF USES



Milk has a rôle in the production of all the articles shown here. Water paints, certain plastics, casein glue, and casein finishes all have the milk protein casein as a base. Lactose is used in fermenting penicillin and giving substance to pills. If milk were not so important as a food, manufacturers would use it more extensively than they do.

quick efficient pasteurization and the least possible exposure of the milk to light and air.

Homemakers should keep milk clean, covered, and cold to preserve its flavor and its nutrients. Exposure to heat, light, and air tends to destroy vitamin C. Exposure to strong light reduces the riboflavin content.

Goat's milk is similar to cow's milk in nutrients. Its fat globules are smaller, and the milk forms smaller curds in the stomach. It may therefore be easier to digest by delicate infants or adults with digestive difficulty. People who are allergic to cow's milk may be able to drink goat's milk.

Commercial By-Products of Milk

MILK serves civilization in several ways apart from its use as food. Lactose has a rôle in the fermentation process that produces penicillin, one of the "wonder drugs" of medicine. It also gives the pharmacist a foundation in which to incorporate drugs in making pills.

Casein has a variety of commercial uses. This page, for example, has been sprayed with a casein solution. Casein coating makes fine book and magazine papers smooth and glossy. Tire manufacturers coat the cord fabric of automobile tires and other tires with casein. It tends to keep the tires from overheating and so helps prevent blowouts. The smooth finish of fine leather may be due to casein.

Paints with a water rather than an oil base contain casein. It acts as a thickening, or emulsifying, agent. Casein paints are a favorite medium for many artists. House painters use water paint on plaster walls, on ceilings, in basements, and over wallpaper.

Glue with a casein base is important in woodworking. Cabinetmakers use it in putting furniture joints together.

Casein plastic was one of the first plastics. Manufacturers made clocks, radios, and similar articles from it. Other synthetics have replaced it except in the manufacture of fine buttons, belt buckles, and some kinds of costume jewelry, in which workability of the plastic and its ability to take delicate colors are important. Manufacturers sometimes make textile fibers and bristles from casein, but other synthetics usually prove cheaper and equally satisfactory.

MILKWEED. The plants of this group are named for one feature which helps them keep alive. Their stems are filled with a milky, sticky juice which is bitter and in some plants poisonous. Many grazing animals let the plants alone for this reason.

The flowers offer nectar to bees, and the bees carry pollen from plant to plant, fertilizing the young seeds. Ripened seeds have plumelike tufts. Passing winds catch these tufts and carry the seeds far and wide. Finally, the plants grow from the same roots year after year; that is, they are perennials.

The most frequently seen member of the group is the common milkweed. It grows in fields and along roadsides from Canada to North Carolina and as far west as Kansas. The thick stem is from two to five feet tall. The leaves are smooth above and hairy underneath. They are from four to eight inches long, and two to four inches wide. From July to September the plant has bell-like clusters of small flowers. They may be greenish white, pink, red, or purple. (For illustration in color, *see* Flowers.)

THE MILKWEED AND ITS FLYING SEEDS

The large picture shows the common milkweed with its clusters of buds and blossoms. At the right, a bursting pod is releasing its fluffy seeds, which float through the air on the faintest breeze.

A Fine Trick to Spread Pollen

Each blossom has five colored horns filled with nectar to attract bees. When a bee lights on a flower, its hind foot slips into a slit which contains pollen. The pollen sticks to the leg, and the bee carries it to other flowers. Sometimes a bee cannot draw its foot from the slit, and it dies among

the nectar horns. In the autumn the flowers develop into spindle-shaped pods. When these pods dry, they crack open and release fluffy clumps of silk with flat, brown seeds clinging to them.

The silk, or floss, is actually a tiny cellulose tube with air sealed inside. When kapok shortages occurred during World War II, milkweed floss served as a kapok substitute in life jackets (*see* Kapok). Like the kapok fiber, it is too short and slippery to be spun into thread or woven into cloth.

Milkweeds belong to the family *Asclepiadaceae*. There are about 2,000 known species, most of which grow in the world's tropical and warm temperate regions. The scientific name of the common milkweed of North America is *Asclepias syriaca*. The swamp milkweed, *Asclepias incarnata*, with attractive clusters of rose-purple flowers, is sometimes used in gardens. The butterfly weed, *Asclepias tuberosa*, is so called because the larva of the monarch butterfly feeds on its leaves. Butterfly weed is sometimes called pleurisy root because the root has been used to treat chest ailments.

MILLAIS (*mĭ-lā'*), SIR JOHN EVERETT (1829-1896). One of England's most honored painters of the 1800's, Sir John Everett Millais, chose traditional subjects for his paintings—landscapes, Bible stories, and portraits. He brought to them an accurate sense of realistic detail and a feeling for life that made his pictures outstanding.

Millais was born in Southampton, England, on June 8, 1829, and spent his childhood years on the island of Jersey and in the French province of Brittany. When he was only nine, his talent for drawing was so well developed that he was placed in a preparatory art school. The same year the boy entered a drawing called 'The Battle of Bannockburn' in the Society of Arts exhibit in London, competing against adult artists for the awards. The audience was amazed when the small, blond boy was called up to receive a silver medal.

'A YEOMAN OF THE GUARD'

Millais here depicts the traditional dignity and colorful costume of the men who have acted as the English Royal Household Guards since 1500.

At 11 he entered the Royal Academy school. In 1847, his last year in school, he won the gold medal for his historical painting, 'The Tribe of Benjamin Seizing the Daughters of Shiloh'. The following year Millais with two friends, Holman Hunt and Dante Gabriel Rossetti, organized the Pre-Raphaelite Brotherhood (*see* Painting, list of terms; Rossetti, Dante Gabriel). This group dedicated itself to a return to the direct, truthful standards of art that existed before the days of the Italian painter Raphael. At first Millais's love of realism expressed itself by a close attention to detail, but after 1860 he developed a more free and vigorous style.

In 1855 Millais married Euphemia Gray, whose previous marriage to John Ruskin had been annulled. They had seven children. Millais was created a baronet in 1885, and in 1896 he was elected president of the Royal Academy, the greatest honor that could be bestowed upon him as an artist. He died Aug. 13, 1896, and was buried in the Painters' Corner in St. Paul's Cathedral churchyard.

Millais painted hundreds of pictures. Among the most noted are 'Ophelia' and 'The Huguenot' (1852), 'The Vale of Rest' (1858), 'Boyhood of Raleigh' (1870), 'A Yeoman of the Guard' (1877), 'The Princes in the Tower' (1878). In his landscapes ('Chill October', 1870, and 'Halcyon Weather', 1892) and in his black and white illustrations for Tennyson's poems and the parables of the Bible, Millais revealed the same sincerity and skill that he showed in his portraits.

MILLAY, EDNA ST. VINCENT (1892–1950). In her career as a poet Edna Millay wrote verse in many different veins and of varying excellence. At her lightest, she wrote almost flippantly; at her most intense, she produced some of the most beautiful sonnets and lyrics in American poetry.

"Vincent," as her family and friends called her, was born Feb. 22, 1892, in Rockland, Me. Her mother supported the family of three daughters by working as a practical nurse. When Edna was eight, the family moved to Camden, Me.

While still a child, she began to write verse, most of it for the little plays and songs that the three girls made up for themselves. When she was 14 one of her poems won the gold badge of the *St. Nicholas* magazine; at her high-school graduation she won first prize for an essay in verse. At 20 she had finished her first long poem, 'Renascence'. A family friend offered to send her to Vassar and she gratefully accepted. She was graduated in 1917.

That same year Miss Millay went to live in Greenwich Village in New York City. She was an early member of the experimental theater group, the Province-

town Players. She acted in their theater in MacDougal Street and also wrote plays for them, notably 'Aria da Capo', a satire on war. Other plays of hers are 'The Lamp and the Bell', 'Two Slatterns and a King', and the opera libretto 'The King's Henchman', for which Deems Taylor wrote the music. It was first produced at the Metropolitan Opera House in 1927.

Miss Millay married Eugen Jan Boissevain in 1923. They had no children. They lived on a farm in New York and spent their summers on an island off the Maine coast. She died Oct. 19, 1950.

Her principal books were 'Renascence' (1917), 'A Few Figs from Thistles' (1920), 'Second April' (1921), 'The Harp-Weaver' (awarded Pulitzer prize 1923), 'The Buck in the Snow' (1928), 'Fatal Interview' (1931), 'Wine from These Grapes' (1934), 'Conversation at Midnight' (1937), and 'Huntsman, What Quarry?' (1939). Some of her prose appeared under the pen name of Nancy Boyd.

MILLET (*mē-lĕ'; also mĭ-lā'*), JEAN FRANÇOIS (1814–1875). At 35 Jean François Millet considered himself a failure as a painter. He left Paris and settled in the little village of Barbizon, France, a place much like his boyhood home. In Barbizon—with farmers, woodcutters, and peasant women for his subjects—Millet painted masterpieces of country life.

Millet was born October 4 in Gruchy, an Atlantic coast village in Normandy. The Millets were peasants and Jean was the second of eight children. Both parents and the children worked in the fields. Jean went to school off and on and read much in his spare time. In his early teens he began drawing. When his brothers were old enough to take his place on the farm, he went to art school in nearby Cherbourg.

When Millet's father died the boy had no money to continue his studies. His schoolmaster convinced the Cherbourg town council that Millet had great talent, and they agreed to finance further study in Paris. Millet went to Paris in 1837. In a few years the small allowance was stopped, and the young artist was on his own. He submitted pictures to exhibitions. Few were purchased and these only at low prices. To earn a living he painted quick portraits and even business signs for a few francs.

His wife encouraged him to leave the city. They went to Barbizon in 1849. The public was slow to see Millet's genius, but other artists understood it. They came to Barbizon to work with him, and the group became known as the Barbizon school of painters. After 1860 Millet was fairly free of financial worry.

Millet painted in somber gray-brown earth tones. His figures have little expression or identity in their faces. Their dramatic appeal is in their work-worn bodies caught at familiar peasant tasks. The figures are set against rural backgrounds—fields at harvest time, barns, woodlots, and peasant cottages. The paintings are strong, almost brutal—especially his famous 'Man with the Hoe'—but Millet's deep understanding of the French peasant brings beauty to these otherwise drab scenes.

MILLET. The staple food for millions of people is the cereal grain called millet. In America and western Europe, where people prefer to eat wheat, millet is almost unknown as human food. However, in many places in India, China, and Africa the land is too poor or the climate too arid to grow wheat, rice, corn, or other cereal grains. In these areas millet is eaten in great quantities. It is high in food value, being rich in protein, fat, minerals, and thiamine. It can be ground into meal or flour or eaten as a whole grain.

From ancient times through the Middle Ages millet was grown throughout the world. It was the "poor man's cereal" in Europe for centuries, but it lost popularity when people developed a taste for yeast-raised bread. Bread dough made with millet flour does not expand with yeast as does a wheat-flour dough. Millet is still used in eastern Europe for making flat bread, porridge, and beer. In western Europe and in the United States it is grown in small quantities, mainly for poultry and livestock feed and for commercial birdseed. The leading producers and consumers are northern China, India, Pakistan, Manchuria, Russia, and French West Africa.

Varieties of Millet

Various parts of the world produce many kinds of millet. Only five varieties are important food crops. European agriculturists sometimes classify certain sorghums, such as kafir and durra, as varieties of millet, but in the United States these are considered members of the sorghum family (*see* Sorghum).

The scientific name of cattail, or pearl, millet is *Pennisetum glaucum*. Most of it grows in the dry western section of India and in Pakistan, where it flourishes on light, sandy soil, little rainfall, and hot weather. Some cattail millet is grown in the African Sudan, near the Sahara. It has a short growing season and can be planted in an emergency if a drought kills a rice or a sorghum crop.

Finger, or little, millet (*Eleusine coracano*) is a hardy variety. Unlike other millets, it thrives in a moist climate, growing in the same areas where rice is cultivated. It is also found high in the Himalayas, growing in rocky soil.

Bread, or proso, millet (*Panicum miliaceum*) thrives as far north as central Russia. It grows swiftly but it needs fairly good soil. It flourishes in central Asia. Nomadic peoples such as the Mongolians and Kirghiz especially relish bread millet.

Foxtail, or Italian, millet (*Setaria italica*) needs good soil and fairly high temperatures. Its growing season is longer than for other millets but it withstands drought well. Foxtail millet is the chief variety grown in northern China.

Barnyard, or Japanese, millet (*Echinochloa crusgali*) is the "barnyard grass" found on American farms. A similar millet is the guinea grass, a native of central Africa. It grows to a height of eight feet and yields a nutritious grain.

Three of these varieties are grown in North America. Foxtail millet makes up most of the American millet crop. It is used largely as a catch or cover

crop in the semiarid farm regions. Some bread millet is grown in the Dakotas, Montana, and adjacent Canada. It matures readily in the short, dry growing season and is cut for hay. Some barnyard millet is grown for the same purpose.

MILNE (*mĭln*), ALAN ALEXANDER (born 1882). The secret of A. A. Milne's gay verses and stories for children probably lies in his own sunny childhood. His father wrote of him: "Finds this a very interesting world, and would like to learn physiology, botany, geology, astronomy, and everything else. Wishes to make collections of beetles, bones, butterflies, etc., and cannot determine whether Algebra is better than football or Euclid than a sponge-cake."


A. A. MILNE

Alan was the youngest of three sons. His father was John Vine Milne, a shy, quietly humorous schoolmaster, devoted to his family. Alan attended his school—where H. G. Wells taught—until he was 11. He then went to Westminster on a scholarship. He was an able student, especially enjoying mathematics and writing, and every kind of sport. At Cambridge he edited a university paper till his graduation in 1903.

Determined to be a writer, he took the little money he had, settled in London, and wrote essays for newspapers and periodicals. Scrimping, he earned his living by writing in the second year, and in 1906 he became assistant editor of *Punch.* In 1913 he married Dorothy de Sélincourt, a writer. From 1915 to 1919, in World War I, he served in England and France.

Soon after his son, Christopher Robin, was born in 1919, he began to write verses and stories for children. These books are loved by children everywhere. They are 'When We Were Very Young' and 'Now We Are Six,' in verse, and the humorous stories of 'Winnie-the-Pooh' and 'The House at Pooh Corner'.

For adults, Milne wrote popular plays, principally comedies, such as 'Mr. Pim Passes By', and 'The Dover Road'. Of all his adult writing, however, the most enjoyable, perhaps, is his 'Autobiography'.

JOHN MILTON

—*Great Puritan Poet and Reformer*

MILTON, JOHN (1608–1674). Next to Shakespeare, John Milton is generally regarded as the greatest English poet, and his magnificent 'Paradise Lost' the finest epic poem in the English language. In other epics and in shorter verse forms Milton showed further proof of his greatness. Although not as well known, Milton's essays in prose are powerful arguments on such subjects as divorce and freedom of the press.

Milton's parents expected great things of him, and he was reared as though he were already a genius. As a young man, he wrote to a friend: "Do you ask what I am meditating? By the help of Heaven, an immortality of fame." This goal that he so clearly set in his early years, he achieved only at the bitter end of his days. Then he was blind and neglected by his three stupid daughters. All his worldly hopes he had seen go down in defeat. His intellectual pride and passion for liberty infuriated the men about him. His own brother wanted him to change his name so that the family might be spared the disgrace of being associated with "a traducer of the State, an enemy of the King, and a falsifier of Truth."

John Milton was born Dec. 9, 1608. In his own words, "I was born in London, of a good family, my father a very honourable man." His father, also named John Milton, son of a stanch Roman Catholic, had turned Protestant while at Oxford and was disinherited. He was a cultivated gentleman, a distinguished musician, and a well-to-do "scrivener" (a sort of attorney and financial agent). Of his six children, three died in infancy. Anne, John, and Christopher, in order of age, were the three who survived and grew to adulthood.

Like his father, John Milton came to be a talented musician; he was said to have had "a delicate tunable voice, and great skill." By his ninth year he was writing verse and was perfecting his Latin and Greek under private tutors. At 12, he was entered at St. Paul's as a day scholar. After that age, he tells us, he scarcely ever quit his lessons before midnight. The brilliant boy was trained to

the limit of his capacities and beyond the limits of his health and eyesight. By the time he left school for Cambridge in his 16th year, he was launched in French, Italian, and Hebrew, as well as Greek and Latin. The pride and hope of his family, who accepted his extraordinary native gifts as a simple and natural thing, he was early dedicated and set apart for scholarship and the church.

"The Lady of Christ's"

Milton was at Cambridge from his 17th to his 24th years. He took his A.B. degree in 1629, his A.M. in 1632. He was a strikingly handsome young man, far advanced in his studies beyond his fellow students. His early biographers agree that he "was a very hard scholar at the University, and performed all his exercises there with very good applause." He was argumentative and quietly assured of his own exceptional gifts. A contemporary said of him "that he was esteemed to be a virtuous and sober person, yet not to be ignorant of his own parts." The curriculum seemed to him antiquated and the tutors mostly bores. The levity of the ignorant young men who surrounded him he frankly despised. It is hardly surprising that he was not universally loved. That he was called "the lady of Christ's" (he was a member of Christ College, Cambridge) was at once a tribute to his good looks and a sarcasm upon the austerity of his life. Milton later observed that he had lived "aloof from vice, and approved by all the good." Though he gave up his intention of entering the Church, when he took his A.B. degree he subscribed "willingly and *ex animo*" to the Book of Common Prayer, the lawfulness of the episcopacy, and the supremacy of the king—all three of which in later years he was to recant.

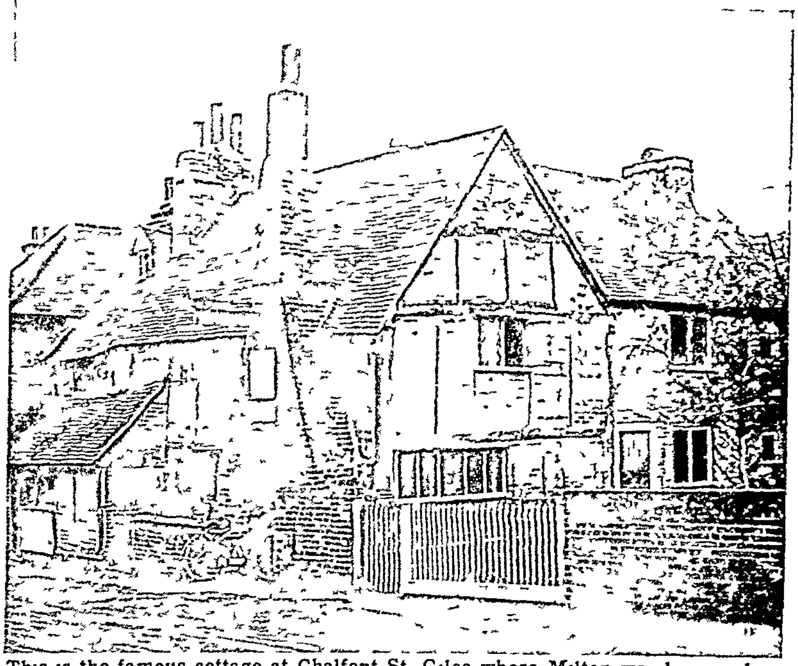
Six Years of Happiness at Horton

Milton left the university in July 1632, with a sense of relief. His father, who was almost 70, had taken a place at Horton, a village near Windsor. Here Milton settled to the arduous task of preparing himself for immortality through "things unattempted yet in prose or rhyme." Of the six years at Horton, he left this summary: "On my father's estate I enjoyed an interval of uninterrupted leisure, which I devoted to the perusal of Greek and Latin authors; though I occasionally visited London, to buy books, or to learn something new in mathematics or music."

During his first year at Horton, in 1632, Milton made his first appearance in public print, in nothing less than the second folio edition of Shakespeare. His eulogy of Shakespeare, written in 1630, was one of the three anonymous pieces to preface that volume. It was at Horton, too, that in trial flight, as he called it, he wrote 'L'Allegro', 'Il Penseroso', 'Comus', 'Lycidas', and some of his sonnets. Though he published his Horton poems in 1645, he never rated them other than preliminary exercises. Yet these minor poems rank high in English poetry, and some critics would less willingly lose 'Comus' and 'Lycidas' than the vaster productions of Milton's later years.

In 1637 his mother died. As he neared his 30th year,

WHERE MILTON FINISHED 'PARADISE LOST'



This is the famous cottage at Chalfont St. Giles where Milton was living when his great masterpiece was completed. He had been driven away from London by the Great Plague in 1665 and remained here nearly two years.

with such stupendous hopes and with so little yet accomplished, alone at Horton with his aged father, solitude and obscurity began to irk him, and he set out on a continental tour. From Paris, where the English ambassador entertained him, he moved on to two months in Florence, where "I found and visited the famous Galileo, grown old, a prisoner of the Inquisition." After two months in Rome, he moved on to Naples where he was checked by news that civil war was brewing in England and gave up his plans to visit Sicily and Greece. "I thought it disgraceful, while my fellow citizens fought for liberty at home, to be travelling for pleasure abroad." But he took his time in returning home, spending six more months in Italy, and tarrying a while in Geneva.

Schoolmaster and Pamphleteer

Milton had been away 15 months. He found that in those troubled times the household at Horton had been broken up, and the family fortunes sadly depleted. "I hired for myself and my books a large house in the city [London], where I happily resumed my interrupted studies." There, about to embark on "the troubled sea of noises and hoarse dispute" as a writer of pamphlets, he undertook the education of the two sons of his sister, Mrs. Phillips. Later he took other pupils as well. Doctor Johnson, in his essay on Milton, looks "with some degree of merriment on the man who hastens home because his countrymen are contending for their

liberty" to "vapor away his patriotism in a private boarding-school." The charge is false. The Long Parliament was called in 1640. In 1641 Milton launched the first of his pamphlets—the gun that opened his 20 years of political warfare, attacking the corruptions of state and church and upholding the ideals of the Puritan party.

"Into a Snare of Misery"

In the spring of 1642 (probably not 1643, as we believed until recently) Milton visited a royalist family

THE BLIND POET DICTATING TO HIS DAUGHTERS

This well-known picture was painted by the eminent English artist, George Romney, in 1793, more than a century after Milton's death.

that lived near Oxford. He returned a married man—a 33-year-old husband with a pretty 17-year-old bride, Mary Powell. It was an unhappy marriage. Mary, says an early biographer, "found it very Solitary; no company came to her." After about a month she went back to her family, promising to return soon. She was away three years.

This marriage brought Milton the first great shock of his life. He saw one of his noblest ideals shattered, and through his fault, as he thought: he had allowed passion to overmaster him. Under the spur of his unhappy situation, he wrote a pamphlet on 'The Doctrine and Discipline of Divorce', advocating freedom of divorce. In passionate language, often of haunting beauty, he set forth ideals of marriage that even today sound rather "advanced." The pamphlet was greeted by a storm of insult, and by an attempt to prosecute him for unlicensed printing. In reply he wrote the masterfully eloquent 'Areopagitica', the most masterly defense of freedom of the press ever written.

His Service to the Commonwealth

From 1645 to 1649, Milton rested his pen and remained a silent witness to the civil war. But a few days before the execution of Charles I, Milton's voice again arose—it was the first to rise—upholding the right of the people to execute a guilty sovereign. With astounding courage (or the audacity of desperation), he published the 'Tenure of Kings and Magistrates' in January 1649. In March of the same year he was appointed secretary for foreign tongues under Cromwell. His duties were to conduct correspondence with foreign states and to write pamphlets setting forth the views of the government. Cromwell and the Commonwealth were backed by their powerful army, but not by popular support. Against them was pitted the whole of European opinion. Milton's task was to educate the ignorant majority at home and to controvert all attacks from abroad. To that task he deliberately sacrificed his eyesight. Physicians warned him that he must stop work or lose his sight. His reply was that, as he had already sacrificed his poetry, so he was now ready to sacrifice his eyes on the altar of English liberty. Complete blindness came in 1652. Worse even than blindness was the shattering of all his ideals and hopes with the downfall of the Commonwealth. After Cromwell's death, monarchy was restored, as Milton saw it, by the "epidemic madness and general defection of a misguided and abused multitude." With the landing of Charles II in 1660, the cause was lost. Milton was forced to go into hiding in a friend's house to escape the vengeance of the Royalists. The House of Commons ordered that he be arrested and that all copies of his pamphlets defending the execution of Charles I should be burned by the hangman. Through the good offices of powerful friends at court he escaped prosecution, but he was actually taken into custody by an officer of the House and released only after the payment of large fees.

The Last Fifteen Years

Now, in his 51st year, blind, embittered, and cramped by the loss of a considerable part of his fortune, Milton was free to resume the poetic task which he had given up 20 years before. His household consisted of three daughters, borne to him by his first wife, who had returned to him in 1645 and had died seven years later. His second wife, Katharine Woodcock, whom he had married in 1656, had died within a few months. His motherless daughters, we are told, gave him much trouble, rebelling against the drudgery of reading to him and writing at his dictation. Finally in 1663 he won domestic peace by taking a third wife, Elizabeth Minshull, a woman 30 years his junior.

With dauntless courage, Milton set about the task which he long had meditated. Nothing in literature is more magnificent than the picture of the blind Puritan dictating day after day the superbly rolling periods of his great epic, 'Paradise Lost'. In 1667, seven years after the Restoration, the task was completed and the world received the book which has had an influence on English thought and language surpassed only by the influence of the Bible and the plays of Shakespeare. The remaining seven years Milton devoted to his second epic, 'Paradise Regained', and to his powerful tragedy, 'Samson Agonistes'.

Contemporaries have left vivid descriptions of Milton's life in these later and calmer years. He would rise at four or five in the morning, listen while a chapter from the Hebrew Bible was read, then breakfast

and work until noon. After an hour spent in walking and another hour in playing on the organ or the viol, he would continue work till nightfall. Then he would have a supper of "olives or some light thing," a pipe, and a glass of water. Visitors would often come in the evening. He died peacefully Nov. 8, 1674, and was buried beside his father in the Church of St. Giles.

Milton's Works and Books About Him

Milton's chief poetical works, with the dates of publication, are: 'Comus' (1637); 'Lycidas' (1637); 'L'Allegro' and 'Il Penseroso' (1645); 'Paradise Lost' (1667); 'Paradise Regained' and 'Samson Agonistes' (1671); 'Sonnets' (published at various times). His best-known pamphlets are: 'Of Reformation Touching Church Discipline' (1641); 'The Doctrine and Discipline of Divorce' (1643); 'Of Education' (1644); 'Areopagitica, a Speech of Mr. John Milton for the Liberty of Unlicensed Printing' (1644); 'Tenure of Kings and Magistrates' (1649); 'Eikonoklastes' (1649); 'Pro Populo Anglicano' (1651).

Younger readers will enjoy the chapter on Milton in 'The Winged Horse'; by Joseph Auslander and F. E. Hill (Doubleday, 1927) (p. 190–204). A good one-volume biography is 'Milton' by Hilaire Belloc (Lippincott, 1935). For advanced study, *see* 'Life of John Milton', 7v., by David Masson (Peter Smith, 1946). Other studies are: 'Milton's Paradise Lost' by J. S. Diekhoff (Columbia Univ. Press, 1946, o.p.); 'The Modernity of Milton' by M. A. Larson (Univ. of Chicago Press, 1927, o.p.); and 'Miltonic Settings: Past and Present' by E. M. W. Tillyard (Macmillan, 1938). There are essays by Augustine Birrell, S. T. Coleridge, Edward Dowden, Samuel Johnson, and Lord Macaulay.

SATAN PLOTTING MAN'S DOWNFALL

This illustration for 'Paradise Lost' was made by Doré, the great French artist. It shows Satan and Beëlzebub immersed in a lake of fire, into which they have been cast after their fall from Heaven. "Upright he rears his mighty stature" the poem says of Satan, and the two fallen but still rebellious angels busy themselves plotting how they can offend God most grievously.

'Paradise Lost' and 'Samson Agonistes'

IF GOD is all-powerful and all-good, how is human suffering to be explained? Milton's triumphant answer is in 'Paradise Lost', where his boldly announced purpose is "to justify the ways of God to man."

No poem is more magnificent in scale and sublime in execution. The stage is Heaven, Hell, the Earthly Paradise, and all the starry universe. The action antedates time and includes all history from the moment of creation. The theme is the biblical story—

> Of Man's first disobedience, and the fruit
> Of that forbidden tree whose mortal taste
> Brought death into the World, and all our woe,
> With loss of Eden . . . .

Following the example of the great classical epics, Milton's epic begins abruptly. Thunderstruck and confounded, Satan and his rebellious angels lie submerged in a great lake of flames, having just been hurled headlong from Heaven. Satan rears himself, and on great wings flies above the burning abyss. He alights on the border of the lake and summons his legions, who build the great palace of Pandemonium. Untamed, Satan is ready for a second war on Heaven. He recalls an ancient prophecy of the creation of a new world, and a new race called Man.

The conclave in Hell plans to circumvent the Almighty by seducing this new race. Satan himself is commissioned to find the new world, and out of the gates of Hell—gates guarded by the monsters Sin and

Death—he plunges through Chaos and Ancient Night. Taking the form of a young angel, he alights on the Sun. Here his appearance deceives the Archangel Uriel who points him to the Earth—a globe suspended by a golden chain from Heaven.

Satan makes his way into Eden and spying about in the forms of bird and beast overhears from Adam and Eve the prohibition against the Fruit of the Tree of the Knowledge of Good and Evil. At nightfall, the guardian angel Gabriel sends two angels to survey Eden. They find Satan, in the form of a toad, whispering dreams into the ear of Eve—dreams of the magical power of the Forbidden Fruit to change her into a goddess.

Raphael is sent by God to warn Adam of the impending doom, and recounts, in the fifth, sixth, and seventh books of the poem, the story of the rebellion in Heaven, of the defeat of Satan, and of Creation. Milton puts into the mouth of the Archangel poetry of unsurpassed magnificence. In the eighth book, Adam, desirous of detaining Raphael, tells of his first awakening after his own creation, his conversation with God, his loneliness, and of the creation of Eve and their nuptials.

Adam and Eve, in their state of Edenic bliss, could have no future but a monotony of endless perfection. It was Eve who changed all that. After her dream, she awakens disquieted. She wants a little time to herself, away from Adam's superiority. She wanders off into the Garden, where Satan is in wait for her, gleefully thankful that she is alone. Satan has taken the form of a regally gorgeous serpent. He quiets Eve's surprise that he can speak by explaining that he has gained the gift of tongues by eating of the Forbidden Fruit. It has brought him not death, but wonderful new powers. And were Eve to eat the apple, she, too, would gain knowledge—knowledge of something that even Adam did not know. Eve eats, only to realize in a terrible afterthought that she has gained a superiority over Adam at the cost of taking on mortality:

> Then I shall be no more;
> And Adam, wedded to another Eve,
> Shall live with her enjoying, I extinct!
> A death to think!

Rather than that, Adam, too, must eat, and companion her in the grave. Out of love for "this novelty on earth, this fair defect of Nature," Adam does eat, and then, in shame and loathing, recriminates Eve. (And the reader's heart is softened just a little, it may be, toward Mary Powell, the 17-year-old bride of Milton's 33d year. Milton never for a moment believed in the equality of the sexes. "Who can be ignorant," he asked in his first pamphlet on divorce, "that woman was created for man, and not man for woman?" He believed with Sir Thomas Browne that woman is but "the thirteenth part and crooked rib of man.")

Satan hastens back to Pandemonium and boasts before his assembled hosts of his triumph over the Almighty. His speech is followed not by applause but by "a dismal universal hiss"—the hissing of the serpents into which God had transformed the once angelic hosts. Satan discovers that he is himself a monstrous crawling snake.

Before the expulsion from the Garden, an angel sets before Adam and Eve, in a great vision, the panorama of history to be unfolded in the centuries ahead. And Adam, at the end (to the surprise of many readers)—

> Replete with joy and wonder, thus replied:
> . . . . Full of doubt, I stand,
> Whether I should repent me now of sin
> By me done and occasioned, or rejoice
> Much more that much more good thereof shall spring.

The Fall, Adam seems to have come to believe, opened up for mankind a career. In a passage of haunting beauty the poem closes:

> Some natural tears they dropped, but wiped them soon;
> The world was all before them, where to choose
> Their place of rest, and Providence their guide.
> They hand in hand with wandering steps and slow,
> Through Eden took their solitary way.

'Samson Agonistes'

In his last work, 'Samson Agonistes', a poetic drama written according to the strictest conventions of classical Greek tragedy, Milton soared again. This drama is magnificent, nearly as splendid and much more human than 'Paradise Lost'. Denis Saurat has justly said: "Did not the majestic proportions of the epic forbid all comparison, one might be tempted, sacrilegiously, to give 'Samson' the first rank among Milton's works." Milton used the biblical story of the blind Samson among the Philistines to give the last and best expression of the history and the moral of his own life. The final mood is tragic serenity:

> Nothing is here for tears, nothing to wail
> Or knock the breast; no weakness, no contempt,
> Dispraise, or blame; nothing but well and fair,
> And what may quiet us in a death so noble.

MILWAUKEE, WIS. The largest city in Wisconsin, Milwaukee lies on the west shore of Lake Michigan at the mouth of three converging rivers—the Milwaukee, the Menomonee, and the Kinnickinnic. It is one of the busiest lake ports, with an excellent harbor protected by four miles of government breakwaters in the beautiful Milwaukee Bay.

The most important item in its lake trade is coal, which is brought in vast quantities to turn the wheels of its varied industries. It is also the chief shipping point for the state's farm products.

The city's manufactures include dairy products, baked goods, packed meat, and canned vegetables and fruits; steam shovels, dredges, and other machinery; motors and engines; farm implements, automobiles and equipment; tinware and enamelware; chemicals and rubber goods; wood, paper, and textile products; and work clothing, leather goods, and work shoes. Milwaukee claims four of the country's seven largest breweries.

Milwaukee has a modern business district and several fine residential areas. Many attractive lake resorts are nearby. It is also proud of its boulevards and public parks totaling more than 5,000 acres. Long-term improvement projects include a civic center.

The city has about 325 churches belonging to 28 faiths. It is the seat of a Roman Catholic archbishop and of a Protestant Episcopal bishop. Its colleges include Milwaukee State Teachers College, Milwaukee Downer, and a branch of the University of Wisconsin. Among its Roman Catholic colleges are Mount Mary, Cardinal Stritch, and Marquette University.

The site of Milwaukee was first visited by white men in 1673, when the Joliet expedition traveled along the west shore of Lake Michigan. Here the Potawatomi Indians had a village. Their name for the area, which white men spelled *Milwacky*, means "good land." In 1818 a settlement was founded by Solomon Juneau, "father of Milwaukee." He became the first mayor when the city was incorporated in 1846.

German immigrants first arrived in 1835. Later they came in such large numbers that Milwaukee was known as a "German" city. Chief among other foreign newcomers were Poles, Italians, Czechoslovaks, Yugoslavs, Swiss, and Scandinavians.

Milwaukee has the mayor-council form of government. The mayor and aldermen are elected for four-year terms. Municipal elections are nonpartisan, one of many changes introduced by the local Socialist party in the decade 1910–20. Population (1950 census), 637,392.

MIND. To many people, the mind is a sort of inner man which looks through one's eyes, hears through one's ears, and thinks one's thoughts. Dictionaries tell us the mind is that part of us which perceives, knows, feels, remembers, thinks, and makes decisions. Some philosophers have regarded the mind as distinct from the body, yet influencing and being influenced by bodily activities. Others have claimed that the mind is a product of bodily activity, and especially of brain functions. Most modern psychologists favor this view. They identify mind with activities of the nervous system and the brain. It is clear that damage to the brain impairs so-called mental activities.

Wilhelm Wundt, the founder of experimental psychology, identified mind with conscious experience, or awareness. Psychology, the study of the mind, was for him a science of experiences like sensations, feelings, and ideas. Sigmund Freud later claimed that mind is much more than conscious experience (*see* Psychoanalysis). He likened it to an iceberg, saying that consciousness is a small portion above the threshold of awareness and the unconscious (or subconscious) the major part below.

Modern psychology is more interested in behavior, or what the individual does, than in his conscious or unconscious mind. (*See also* Brain; Psychology.)

SUBSTANCES *in the* THIRD *Great* "KINGDOM"

MINERALS. "Animal, vegetable, or mineral?" we ask in the old guessing game, assuming that what did not fit into the first two "kingdoms" was bound to belong in the third. For general purposes this is true, but the scientist draws a closer distinction. To be classified by him as a *mineral species*, a substance must exist in a natural state and have a definite chemical composition. Glass, for example, is made by man from widely varying mixtures and compounds, and it has no standing in the field of *mineralogy*. A few minerals, including certain types of limestone and iron ore, are believed to have been produced by living plants and animals. Virtually all true minerals are of nonliving origin. Thus coal, petroleum, and amber are not true minerals in a strict sense, although they are usually considered so.

The rocks of the earth's crust consist of minerals, often of many kinds mixed together; so do the vein deposits which provide most of our useful ores. Other minerals may be deposited by the waters of lakes or hot springs or be formed in active volcanoes. Minerals constitute the chief raw materials of chemistry and of many great arts and industries. Indeed, the search for and the gathering of useful minerals, as well as of those which are beautiful and rare enough to be classed as gems, provide one of the most important and romantic chapters in the history of our civilization. (*See* Chemistry; Civilization; Jewelry and Gems; Mines and Mining.)

No one knows exactly how many mineral species exist. Mineralogists differ among themselves in the distinctions they draw between many of the known species. Probably about 2,000 have been recognized by science, and less than 150 are important industrially or scientifically.

The ending *ite* is characteristic of most mineral names. To the beginner these names often seem strange and difficult because they contain a kind of shorthand description or history of the mineral in question. Many are named after the men who discovered them or in honor of distinguished scientists. Others get their names from the place where they are found or from some outstanding characteristic such as color, heaviness, or their chief chemical ingredients.

Mineralogists identify minerals chiefly by *color, hardness, cleavage, crystal form*, and sometimes by simple chemical tests. Related to the color of a mineral are *transparency* and *luster*. The *streak* is the color produced when a piece of the mineral is drawn over the surface of rough, unglazed porcelain. It is often different from the surface color of the specimen.

The hardness of minerals usually is stated in terms of the *Mohs scale* of hardness. Ten typical minerals are arranged in order of their hardness:

1. Talc	6. Feldspar
2. Gypsum	7. Quartz
3. Calcite	8. Topaz
4. Fluorite	9. Sapphire
5. Apatite	10. Diamond

If a mineral is hard enough to scratch feldspar but is scratched itself by quartz, the mineral is said to have a hardness between 6 and 7 on the Mohs scale.

The cleavage of minerals is the way they split or break, as mica, for example, which splits into thin flat

sheets. This and many other properties of minerals are controlled by their crystal form (*see* Crystals). Six crystal systems are commonly recognized by mineralogists, distinguished by the length and direction of the three or more axes which may be thought of as existing inside any crystal. These systems are:

(1) *Isometric:* three axes of equal length and at right angles to one another. A typical form is the cube.

(2) *Tetragonal:* two of the right-angle axes are equal in length, while the third one is longer or shorter. A typical form is a square prism like a section of a square column.

(3) *Hexagonal:* three axes of equal length, in the same plane and equally spaced around the center, with a fourth axis at right angles to the plane of the three. A typical form is a six-sided prism. The so-called rhombohedral system is a part of the hexagonal system as thus defined.

(4) *Orthorhombic:* three axes at right angles to each other, all of different lengths. A typical form is a prism of three unequal dimensions, like a brick.

(5) *Monoclinic:* two axes unequal in length at right angles to each other, with a third axis still different in length inclined to the plane of the other two. A typical form is a prism with its top and base inclined to its sides, like a brick distorted sidewise.

(6) *Triclinic:* all three axes unequal in length and inclined to each other. A typical form would be a brick distorted both sidewise and endwise.

It must be understood, of course, that the experienced mineralogist rarely needs elaborate tests and methods of identification to distinguish mineral specimens; he learns to recognize most of them at sight, just as a botanist recognizes different plants or as a man recognizes his friends.

A few chemical elements are found free in nature, and are then called *native.* Gold, platinum, and copper are the chief native metals, although most of the world's copper is obtained from mineral compounds. Native iron occurs in meteorites. Mercury, lead, and silver are also encountered in uncombined form. The commonest non-metallic native element is sulphur. Carbon exists native in two forms, diamond and graphite.

Important Minerals and Their Value

The following paragraphs describe the important minerals from the point of view of interest and industrial value. The names mentioned are those most likely to be met in general reading.

Among the leaders are the sulphide minerals, many of which are used as ores. Lead sulphide forms the mineral *galena,* silver sulphide forms *argentite,* and zinc sulphide forms *sphalerite.* The three often are found mixed together. Two important sulphides of arsenic are *realgar* and *orpiment.* Antimony sulphide is *stibnite,* used both as an ore of antimony and in powdered form for safety matches and cartridge primers. The noted mineral called *cinnabar* is a sulphide of mercury. The sulphide of molybdenum, called *molybdenite,* is the chief ore of that metal.

There are three very important iron sulphides, called *pyrites, marcasite,* and *pyrrhotite,* all differing slightly in chemical composition. Pyrites is also known as fool's gold, being a yellow mineral with a brilliant luster, somewhat resembling to inexperienced eyes flakes of native gold in a rock. Two copper sulphides exist as minerals, called *chalcocite* and *covellite.* Many important ore bodies consist of mixtures of the copper and iron sulphides, notably *bornite* and *chalcopyrite.*

A second great mineral group consists of carbonates, including the plentiful mineral *calcite,* which is calcium carbonate. Large transparent crystals of calcite are called *Iceland spar. Satin spar* is a somewhat less pure, translucent variety. Ordinary *limestone* consists largely of calcite. *Marble* is calcite in crystallized form and capable of taking a polish, the various colors of ornamental marbles being caused by chemical impurities or by veins of other minerals. The *stalagmites* and *stalactites* found in caves usually consist of calcite. *Marl* is an impure limestone, imperfectly hardened. *Chalk* also contains calcite, often in the form of microscopic shells of sea animals. *Aragonite* has the same chemical composition as calcite, but a different crystal form.

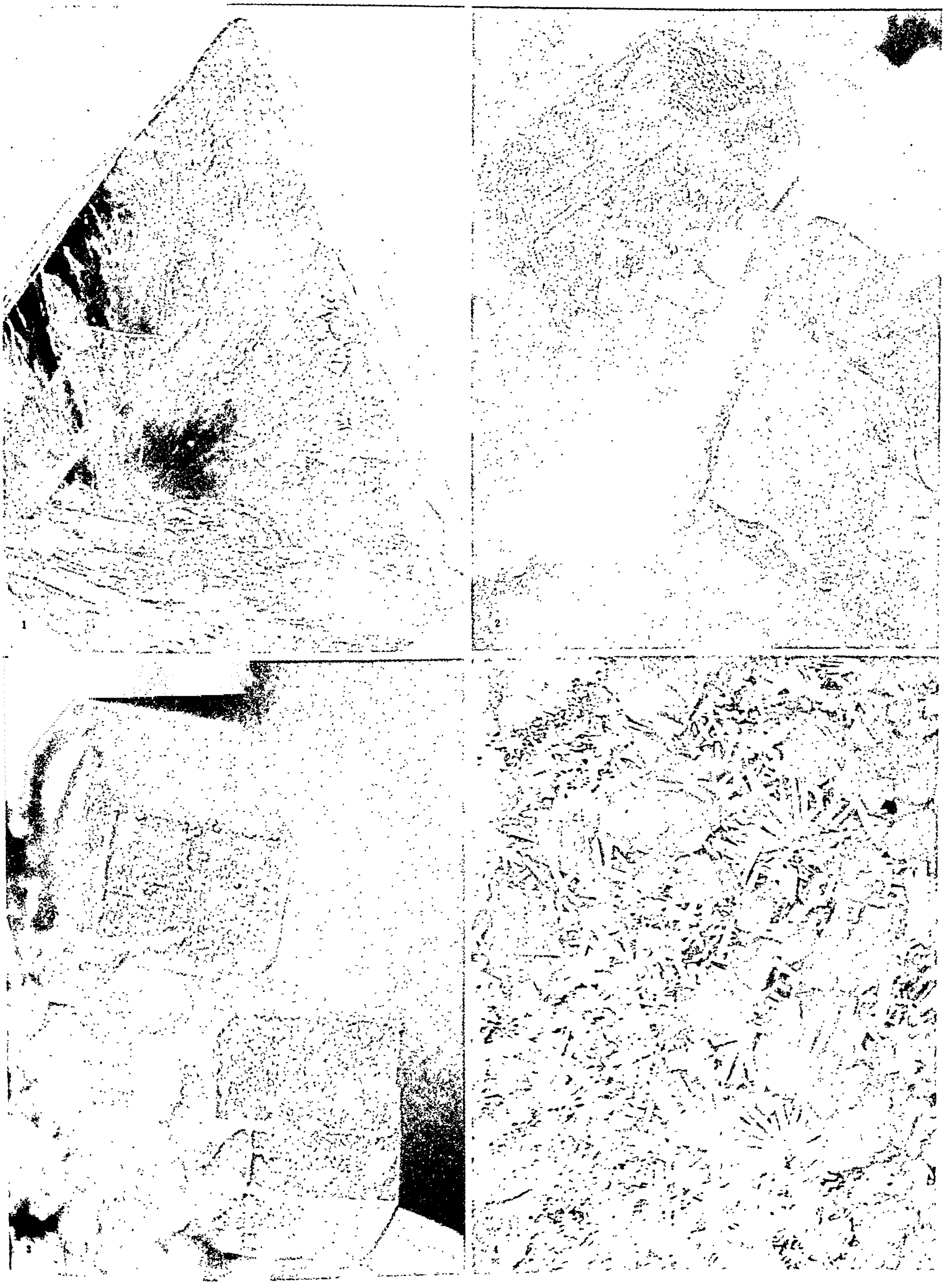
Another well-known mineral in this group is magnesium carbonate, called *magnesite.* This frequently occurs mixed with calcite, forming *dolomite,* or dolomitic limestone. Two copper ores of some importance are the copper carbonates, *malachite* and *azurite,* either of which may exist in beautiful green or blue crystals sometimes used as ornamental stones. Iron carbonate exists as the mineral *siderite,* once much used as an ore of iron. Manganese carbonate, called *rhodochrosite,* is an occasional ore of that metal.

The Group of Oxides

The chemical group of oxides includes the commonest and most widespread mineral of all, silicon oxide or *quartz,* also called silica. Quartz is found in a great variety of forms including many semi-precious stones (*see* Quartz; Silicon). *Sinter* is an impure quartz deposited by hot springs. *Silex* is a name sometimes given to powdered quartz, either natural or artificial, often used in polishing. *Diatomaceous earth* or *kieselguhr,* also called tripolite or tripoli powder, is a powdered quartz containing myriads of siliceous cell walls of the microscopic water-plants called diatoms. Two minerals consist of the chemical elements of quartz combined with water. One of these is called *tridymite.* The other is *opal,* including the fire opal and other gems of the group.

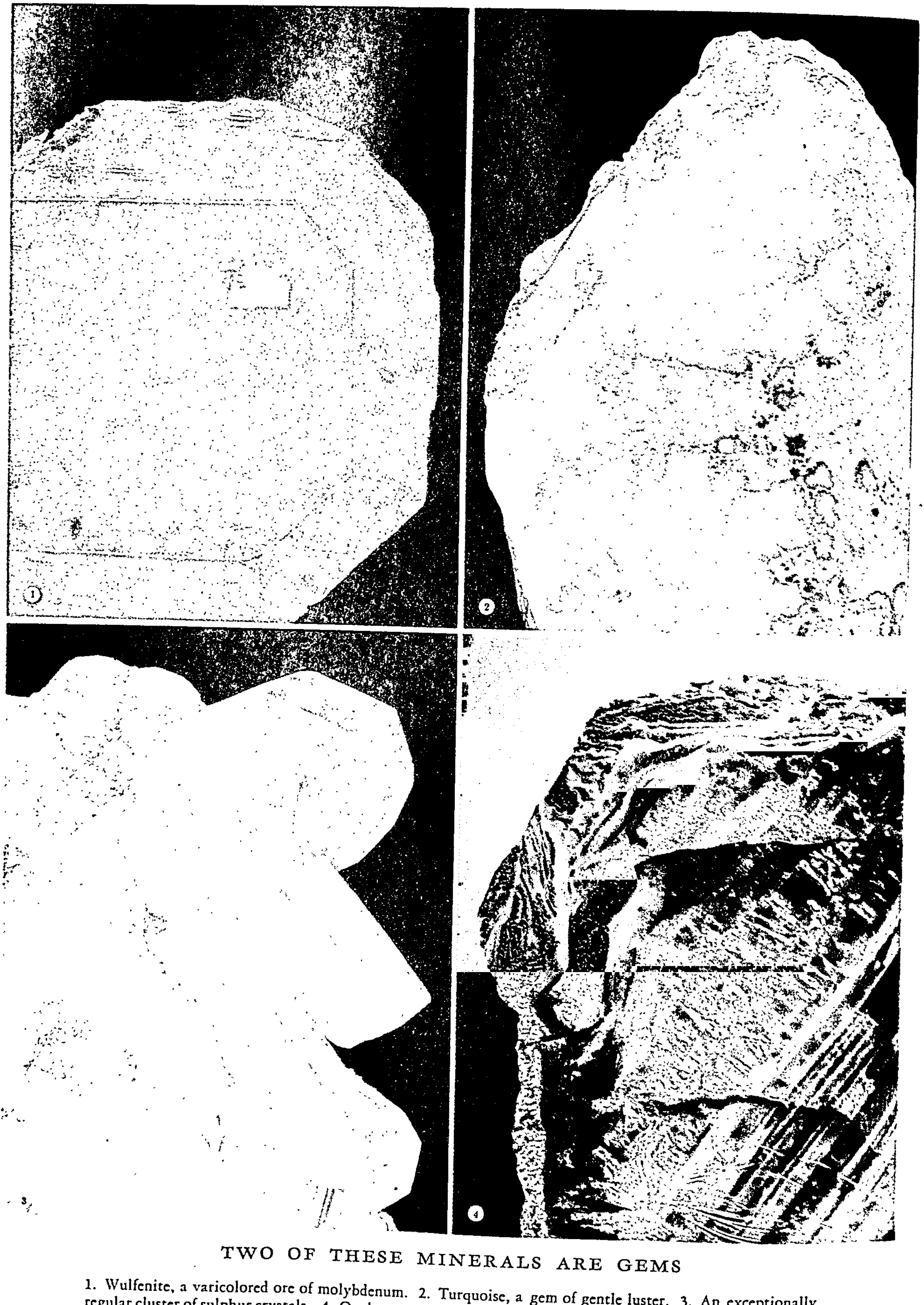
Among the important metallic oxides which exist as minerals are *cuprite* or copper oxide, *zincite* or zinc oxide, *cassiterite* or tin oxide, *rutile* or titanium oxide, and *pyrolusite* or manganese oxide, the last being the chief ore of manganese. The chief ores of iron are also oxides called *hematite* and *limonite,* the latter containing chemically combined water. *Magnetite,* of which lodestone is the magnetized variety, is another iron oxide. *Ilmenite* is a mixed oxide of iron and titanium existing in large deposits. It is a chief source of the titanium used as a paint pigment (*see* Paints and Varnishes) and as a purifier in alloys (*see* Alloys).

Aluminum oxide, known in mineralogy as *corundum,* exists in two transparent and beautifully colored forms, *sapphires* and *rubies.* In both instances the color is due to traces of impurities. Impure corundum



MINERAL CRYSTALS OF GEMLIKE BEAUTY

Under suitable conditions many minerals form beautiful gemlike crystals like those shown here: 1. Fluorite. 2. Realgar, or arsenic sulphide. 3. Vanadinite, an ore of vanadium. 4. Rhodochrosite, a source of manganese.



TWO OF THESE MINERALS ARE GEMS

1. Wulfenite, a varicolored ore of molybdenum. 2. Turquoise, a gem of gentle luster. 3. An exceptionally regular cluster of sulphur crystals. 4. Opal, a noncrystalline gem, formed in thin layers that pulse with color.

forms the *emery* used in powdered form for grinding and polishing. *Bauxite*, the principal ore of aluminum, is an oxide chemically combined with water; *spinel* is a mixed oxide of magnesium and aluminum; and *chromite* is an iron and chromium oxide constituting the chief ore of chromium.

The chief phosphate mineral is *apatite*, which is phosphate of calcium containing a little fluorine. An impure form of it is the *phosphate rock* used for the manufacture of fertilizers. A complicated phosphate mineral of some practical importance is *monazite*, usually found in sea-beach sand and the chief source of the rare metal cerium, used for gas mantles and for the fire-making alloy employed in cigarette lighters. The metal tungsten, now important for the manufacture of electric lamps, comes chiefly from two minerals, *scheelite*, which is calcium tungstate, and *wolframite*, which is a mixed tungstate of the elements manganese and iron.

The leading radioactive minerals, used as sources of radium, uranium, thorium, and similar elements, are *uraninite, carnotite, broggerite*, and *cleveite*. All are complex oxides of the radioactive and other elements, usually containing lead. (*See* Radium, Radioactivity.) *Pitchblende*, in which mineral radioactivity was first discovered, is an impure, poorly crystallized uraninite.

A relatively few minerals, some of which are of considerable practical importance, are soluble in water and form the group of *salines*. Most prominent of these, of course, is sodium chloride, or common salt, known in its mineral form as *halite*. Potassium chloride, called *sylvite*, is one of the important minerals in the famous Stassfurt mines in Germany, still the world's chief source of potash. Other important Stassfurt minerals are *carnallite*, which is a mixed chloride of calcium and magnesium; *polyhalite*, which is a calcium and magnesium chloride and sulphate; and *kainite*, similar in composition to polyhalite. At Searles Lake in California, now the chief American source of potash and borax, there is a large, porous body of halite and another saline mineral called *trona*, a complex carbonate of sodium. In the interstices of this saline mass exist millions of tons of a brine containing potash and borax. Other sources of borax are *colemanite* and *rasorite*, both of which are complex borates of lime.

Another water-soluble carbonate of sodium existing occasionally in desert regions as a mineral is *natron*, of the same chemical composition as crystal washing soda. Sodium sulphate, known chemically as Glauber's salt, exists as the mineral *mirabilite*. Epsom salt, chemically magnesium sulphate, exists as the mineral *epsomite*. Potassium and sodium nitrate exist as minerals respectively known as *niter* and *soda niter*. The latter is the most valuable ingredient in the *caliche* from which commercial nitrates are produced in Chile. (*See* Fertilizers.)

A chloride mineral related to the saline group but not so easily soluble in water is the copper chloride called *atacamite*, an important ore of copper in Chile. Sulphates, also insoluble but related chemically to the saline minerals, are *barite* or *barytes*, a barium compound; *celestite*, an important ore of strontium; *alunite*, an aluminum and potassium sulphate; and *gypsum*, a calcium sulphate containing water, which is the source of plaster of paris. Transparent crystals of gypsum, often in plates or in arrow-head form, are known as *selenite*. Calcium sulphate is found uncombined with water and is called *anhydrite*.

QUARRYING A COMMON MINERAL IN ENGLAND

Tons of chalk are used every year in England, for much the same purposes as limestone is used in the United States. The great chalk cliffs here at Mitcheldever, in Hampshire, furnish many carloads of building material. This chalk contains calcite, which is calcium carbonate, often in the form of microscopic shells of millions of marine animals.

Two Important Fluorine Minerals

Two fluorine minerals are important: calcium fluoride or *fluorite*, also known as fluorspar; and *cryolite*, which is a double fluoride of aluminum and sodium. Fluorite is used as a flux in many metallurgical operations, and the rare clear crystals of this mineral are invaluable for making lenses to be used with ultraviolet rays.

The most numerous minerals, and the commonest except for quartz, belong to the group of silicates consisting of silicon and oxygen combined with potassium, sodium, magnesium, aluminum, iron, and many

other elements. A prominent group of silicates are the *feldspars,* including *orthoclase,* a potassium and aluminum silicate; *albite,* containing sodium instead of potassium; *oligoclase,* containing calcium in addition to sodium. A related silicate is *leucite,* containing potassium and aluminum and often suggested as a possible source of potash. Another prominent group of silicates contains the *micas.* The yellowish, transparent mica often used for stove windows is *muscovite,* consisting chiefly of silicates of potassium. A common black mica is *biotite,* containing magnesium and iron. *Lepidolite,* containing lithium, is one of the relatively few ores of that metal.

The mineral *pyroxene,* also called *diopside,* is an important rock-forming mineral together with the feldspars and micas. It is a complicated silicate of calcium and magnesium, sometimes containing aluminum or iron. One of its varieties is *spodumene,* sometimes found as a clear pink crystal and used as a gem under the name of *kunzite.* Another variety of pyroxene forms *jadeite,* which is the true Chinese jade.

Asbestos and Talc

Closely related to pyroxene is *amphibole,* an even more complicated silicate. A variety called *hornblende,* containing aluminum, sometimes occurs in long, fiber-like crystals forming one kind of *asbestos.* Another kind of asbestos is a fibrous variety of the mineral *serpentine,* which is a hydrous magnesium silicate. Similar to serpentine in composition is *talc,* the source of talcum powder. *Soapstone* and *steatite* are varieties of talc, usually impure. *Meerschaum,* used to make tobacco pipes, is another hydrous silicate of magnesium. Still another iron and magnesium silicate, also important in rock formation, is *olivine.*

A hydrous silicate, somewhat like talc but containing aluminum instead of magnesium, is the mineral *kaolin.* The majority of clays consist of impure kaolin. The *fuller's earth* used in cleaning cloth is also a variety of kaolin. *Greensand,* which covers large areas in New Jersey and has been suggested as a source of potash, is an impure claylike material containing grains of the mineral *glauconite,* an iron and potassium silicate.

Some Brilliant Gems

Tourmaline, a complicated iron, aluminum, and magnesium silicate containing some boron, frequently appears as a minor constituent of rocks. It is found also as large transparent crystals sometimes used as gems but even more valuable in physical laboratories for the study of polarized light (*see* Light). *Zircon,* a silicate and chief ore of zirconium, may form clear crystal gems called *hyacinths.* *Topaz* is an aluminum silicate containing some fluorine. *Beryl* is an aluminum and beryllium silicate forming the chief ore of beryllium. The *emerald* and *aquamarine* are crystal forms of beryl, the former containing traces of chromium. Two zinc silicates are of importance: *willemite,* used in physical experiments because X-rays render it fluorescent; and *calamine,* sometimes valuable as a zinc ore. Several hydrous silicates, chiefly of potassium and calcium, called *zeolites,* have come into use recently for the softening of water. The most important one is *apophyllite,* but for commercial purposes zeolites are now usually made artificially.

We have seen that a few rocks, like limestone and quartzite, consist of single mineral species, but most of them contain several minerals mixed together. Nevertheless, many of these mixtures recur so uniformly that they have acquired distinctive names. Geologists divide rocks roughly into *sedimentary* rocks, formed from sand, clay, or other material deposited in water; *igneous* rocks, formed by volcanic or other intense heat; and *metamorphic* rocks, originally sedimentary but later modified by heat or other natural processes. (*See* Geology.)

Sedimentary and Igneous Rocks

The commonest sedimentary rocks are *sandstone* and *shale.* The former consists of visible sand grains, while the latter consists mostly of finer material frequently containing kaolin. *Argillite* is the fine-grained, stratified variety of shale which is used for roofing slates or natural writing slates. *Oil shale* contains more or less petroleum or asphalt derived from microscopic plants or animals buried with the shale when it was laid down. *Conglomerates* include the very coarse-grained sandstones often containing pebbles or even large bowlders. *Alluvium* is the geologist's name for surface sedimentary deposits not yet hardened into rock. *Till* is a variety of claylike alluvium, often containing bowlders and pebbles, believed to have been deposited by glaciers. *Loess* is a fine-grained material probably laid down as wind-blown dust during the Glacial Period.

One of the chief igneous rocks is the familiar *granite,* made up of crystals of quartz and feldspar, usually mixed with other minerals. *Gneiss* has the same mineralogical characteristics as granite, but shows traces of stratification, as though it had been formed by the partial melting of a sedimentary rock. Many geologists believe this to be a fact and imagine that many granites, also, are really metamorphic rocks that were formed deep in the earth's crust by the melting of rocks like sandstone or shale. *Schists* are still more clearly metamorphic, apparently formed by the partial recrystallization of shales under the action of heat or hot water. More certainly of true igneous nature are *trachite, syenite, diorite, dunite, dacite,* and *gabbro,* consisting of varied mixtures of quartz, feldspar, and other rock-forming minerals.

Rocks of Volcanic Origin

Any melted rock poured out by a volcano is called *lava;* there being two chief types, the blackish, heavy lava called *basalt,* and the lighter-weight *rhyolite,* usually of reddish color. *Pumice* is a porous, frothy lava produced when the melted rock contains gas bubbles so that it is raised on escaping from pressure, just as bread is raised by yeast. *Obsidian* is a glass-like rock produced when certain kinds of lava cool so rapidly that there is not time for the crystallization of individual minerals. Because it breaks with sharp

edges, obsidian was much used by primitive men for arrow-heads, knives, and other tools. *Volcanic ash,* also called *tufa* or *tuff,* consists of tiny fragments of glasslike obsidian or pumice blown out into the air in millions of tons during volcanic eruptions.

Coal and *oil* are not really mineral species, but the remains of plant and animal materials buried between layers of sedimentary rocks and slowly changed more or less completely by heat, pressure, and percolating water, very much as shales or sandstones may be converted into schists or other metamorphic rocks (*see* Coal). All grades of carbonaceous or oily shales and sandstones are due to the burial of mixed mineral and organic débris. The gem called *amber* also is of living origin, being the gum of ancient trees similarly buried and partly converted into harder material. Animal bones, tree trunks, and many other materials buried with sedimentary rocks may be *petrified* or *mineralized* with quartz, calcite, or other minerals, thus producing *fossils.* (*See* Fossils.)

Minerals Essential to Life

In recent years experts in diet have learned that several mineral elements are essential in human foods. Under normal conditions plant roots extract these from the soil and pass them along to us either directly, in our vegetables and fruits, or indirectly, through the flesh, milk, or eggs of plant-eating animals. By growing too many crops in a field or garden without restoring the requisite minerals to the soil, we may rob ourselves of some of the necessary ingredients of our diet.

Both sodium and chlorine in the form of common salt are essential to ordinary animal life. Calcium and phosphorus are required for the manufacture or repair of bones and for other purposes. Many foods, including milk, contain them. Iron is necessary for the blood, and is supplied by red meat and by many vegetables, especially leafy ones like spinach. The small amounts of potassium and sulphur believed to be necessary for muscle fibers and other cells are also supplied by vegetables. The iodine required for the thyroid gland may be lacking in the natural drinking waters of certain regions, and may need to be secured from sea foods or from iodized salt. Some soils contain iodine and impart it to vegetables grown in them. The traces of fluorine, often found in vegetables and drinking water, help to harden the teeth, but too much of it discolors and impairs the enamel. Copper seems necessary to foster the production of hemoglobin in the blood. Like iron, it comes in red meat and fresh vegetables. Zinc has been proved essential to plant and animal growth. Magnesium is necessary for the formation of chlorophyll in plants, and animals deprived of it die in convulsions. The traces of manganese and boron found in both animals and plants appear to play an important part in their growth.

(*See also* the articles on the principal metals and other elements for further minerals used as ores, chemicals, pigments, etc.)

MINERVA. The Roman goddess of wisdom, science, and the arts, identified with the Greek Athena. Her oldest sanctuary at Rome was the temple built by Tarquin on the Capitol, where she was worshiped with Jupiter and Juno. Another of her temples, on the Aventine, was the meeting place for dramatic poets and actors, who were organized into gilds under her patronage in the 3d century B. C. All the school children had a holiday on the day of her festival, the 19th of March. (*See* Athena.)

How MAN WINS TREASURE *from the* EARTH'S DEPTHS

WHEN you look at a piece of coal or iron, or at gold and silver watches, rings, pins, diamonds, rubies, etc., in jewelry shop windows, you may recall that once, in their original crude states as minerals, metals, or gems, they were all snugly secreted by Nature in treasure chests in the earth, in some cases thousands of feet underground. But do you ever consider how the precious stores are got out of their hiding places and won for the use of mankind in making life effective, comfortable, secure, and beautiful? It is by the toilsome and fascinating processes described in this article.

MINES AND MINING. Mining is one of the great basic industries. The annual output of the mines, quarries, and petroleum and natural gas wells of the United States rank high in the production of the nation's annual income. These products in turn help make others which add to the national wealth. Simply moving minerals from their source to where they will be used or converted is a large part of the transportation industry. Annually the task involves millions of trips by railroad cars and trucks and passage through hundreds of thousands of miles of pipeline. In normal years the mining industry is the biggest single purchaser of explosives. Workers in the extraction and transportation of minerals make up a labor force of millions. Millions more are employed in the allied industries, such as the manufacture of iron and steel, copperware, coke, chemicals etc., which are directly based on the mining industry.

The story of mining is one of tragedy and romance. The mining field is the world's roulette table. In a day the man who thought himself wealthy may become a pauper, the pauper may become a millionaire. A single stroke of pickax or spade has again and again uncovered a fortune. Yet for every fortune made in mining a hundred still remain. In modern times mining has lost much of its former element of chance, and now is organized and conducted much like other sorts of business, with perhaps a larger element of risk in the early stages.

Even the dangers of mining whet the imagination. Fire, water, poisonous gases, breaking ropes and ladders—no wonder the mountain miners of Germany peopled their mines with goblins and prayed to the saints before descending. The world little realizes

the magnitude of the debt it owes to the "toilers of the deepest deep."

Prospecting for gold is relatively simple. Gold is rarely dissolved by earth waters; so when deposits are washed away, pure gold accumulates with sand and gravel along the stream. The prospector fills a pan with the sand or gravel and water, and then rocks and whirls it to permit the heavier gold to sink to the bottom, gradually removing the lighter material at the top until a few nuggets, flecks, or fine particles of gold remain in the angle between the sides and bottom of the pan. When he finds gold-bearing gravels, the prospector follows them upstream, panning gravel as he goes, in order to locate the vein or "mother lode" from which the stream washed the gold.

Mines yielding metal-bearing sands and gravels are called placer mines. Tin, platinum, chromium, and a few other metals are found in placers, while lead, silver, copper, and zinc are mined almost entirely from veins or lodes that lie in solid rock. Many lodes crop out as ledges at the surface, and lead and silver veins are often rich in those metals at the very surface. Copper and zinc, on the other hand, are generally leached out of the surface ores by water that dissolves the metals and carries them away, so such deposits are generally found by digging down into a streak of rusty iron ore. Iron is nearly always present in copper and zinc lodes, and the iron is rarely all removed by earth waters. The zinc and copper ores appear in depth at places where they have not been dissolved and carried away.

Hunting for Oil

Prospecting for oil and gas presents some novel features. These fuels are found together with salt water in beds of sedimentary rock, where they have been formed from the decomposition of remains of plants and animals that were buried with the beds in the sea. When formed, the beds were nearly flat, but at many places the rocks are folded up so that they form *anticlines*, or up-folds, and *synclines*, or down-folds. The oil and gas rise to the top of the up-folds, collecting in domes or basins. In prospecting for oil the rocks that crop out are studied, particularly those that carry oil seep or asphalt, for natural asphalt is the dried residue of oil. (*See* Petroleum.)

If rocks at the surface dip away from an area in all directions, the oil-bearing rocks below are likely to dip in the same manner, indicating the presence of a dome or basin beneath the surface. Consequently, the geologist, prospecting for oil, searches for anticlines.

Geophysical prospecting depends upon some physical property of the hidden deposit, such as its magnetic properties, its gravity or mass, its electrical effects, or its effects upon earthquake waves formed by explosions. Certain ores of iron have strong magnetic attraction and can be discovered by the magnetic needle, which has but a limited use because so few ores are magnetic. Plumb bobs and pendulums are utilized in discovering heavy ore bodies, by taking advantage of the relatively greater gravitational pull of heavier bodies (*see* Physics). In hunting for oil, geophysicists try to find the rock formations that usually act as oil *traps* (incorrectly called oil *reservoirs*). They lower dynamite into holes from 60 to 100 feet deep. The holes are drilled about one-quarter of a mile apart. When the dynamite explodes, it sets up shock waves. Seismometers along the top of the ground around each of the shot holes record the time it takes the shock waves to be reflected back from the layers of rock below. This method of geophysical prospecting is called *seismography* or *reflection shooting*. When reflection shootings are made over a large area, geophysicists compare the reflection time for each layer and judge where rock layers rise and fall about the field. Thus, they are able to locate the dome formations that often trap oil (*see* Petroleum).

Other methods of geophysical prospecting include the use of electric currents. Where sulphides are attacked by earth waters, feeble electric currents are generated. By measuring them and locating their sources such deposits may be found. By other methods, electric currents are generated and their behavior in the ground studied, and the locations of disturbing ore bodies or other deposits determined.

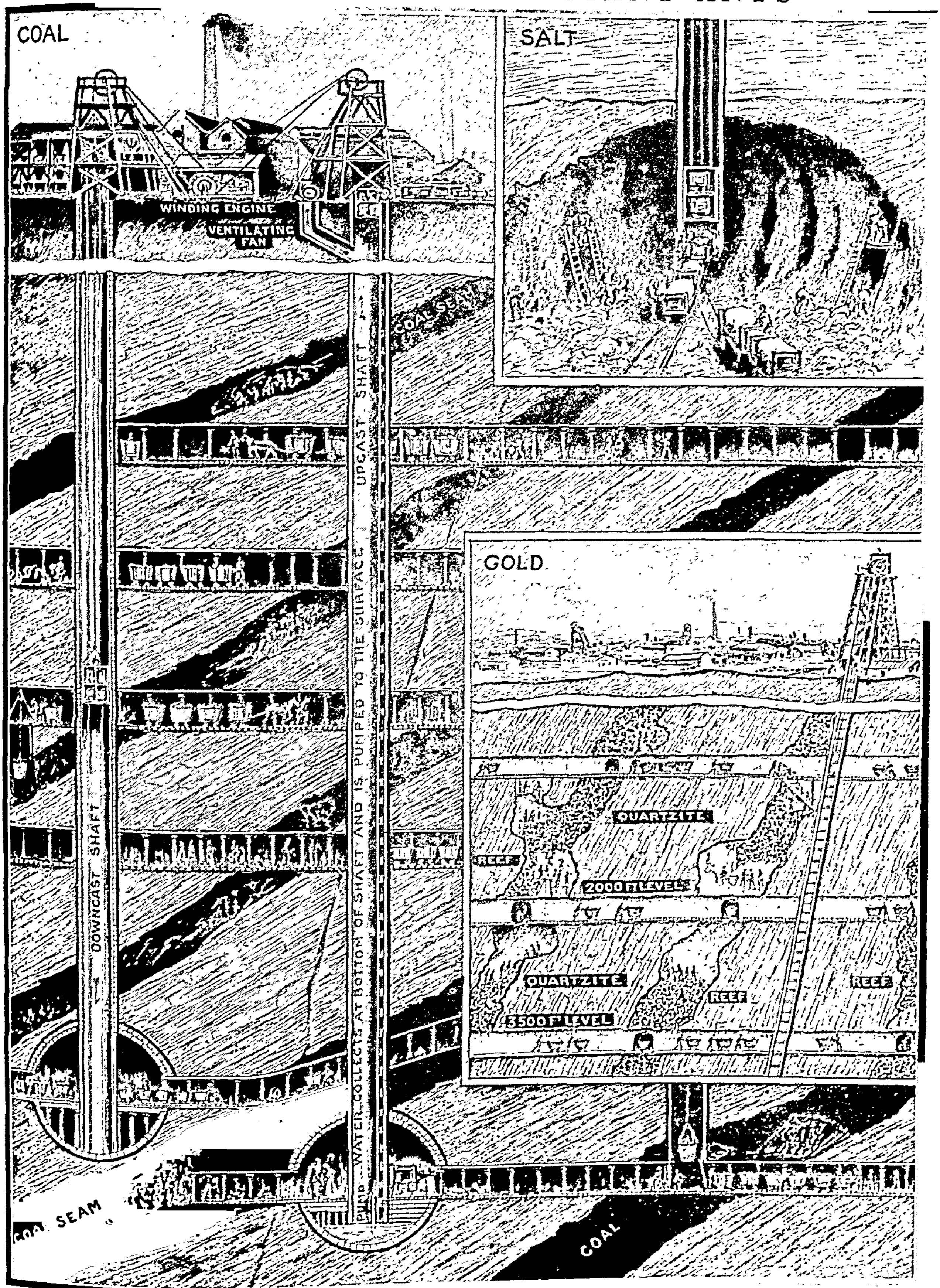
Thus other sciences have come to the aid of the geologist and the prospector in the task of discovering ores. Topographic maps are made by the photographer from airplanes, and to a certain extent the geology of certain areas has been mapped from airplanes. The magnetic needle, the pendulum and plumb bob, the earthquake recorder, the radio, and the electric current generators have all proved useful. Most of these devices, however, are limited in scope, for the effect of physical properties of deposits decreases rapidly with the distance; so little reliance can be placed on them where the ore bodies are more than a few hundred feet deep. As we learn more about these physical properties of deposits, and as we learn to record various effects more accurately, the use of such methods will probably increase and their records will become more reliable.

Suppose the prospector has finally determined that the desired mineral is present in a given region. To determine the extent of the deposit he may make further examination by stripping off the soil; or he may dig shallow pits, or trenches. Mining fields the world over are dotted with such excavations, each telling, in its abandonment, a story of hope and failure.

The more usual method of testing ground is by borings, made by means of a diamond drill, a long metal tube with black diamonds at the ends for cutters. When rotated at high speed, the tube extracts a core of rock. Holes have been thus drilled several thousand feet deep, in some cases at the rate of 60 feet a day. In hard rock, the rate is slower.

If these explorations indicate valuable ore, the prospector or the company stakes out a claim and begins to develop a mine. Mining methods vary according to whether the minerals are found (1) in alluvial deposits (gravel, sand, silt, etc.) on the sur-

LIKE THE HOMES OF GIANT ANTS



These three pictures tell the story of how men work in getting coal, salt, and gold out of the earth. The general principle in all is much the same, the excavated material being brought to a shaft and hoisted to the surface. You can see also how the veins or seams of the minerals are followed by the miners in their underground burrowing.

face; (2) in layers or beds beneath the surface, like iron ore, coal, and salt; or (3) in veins or seams (often called "lodes"), some of which are merely fillings in old cracks or fissures in rocks.

Mining in alluvial deposits is called placer mining. Placer mining is carried on in various ways, but the essential thing is to cause water to flow over the sand and gravel, so as to wash away the lighter material and leave the heavy and useful mineral behind (*see* Gold). "Open-pit" mining is the term applied where ores are uncovered and scooped out with the aid of steam shovels. The latter method is widely used in the Minnesota iron mines, and in some of the copper mines of the southwest.

Making Shafts and Tunnels

For vein and bed deposits beneath the surface, tunnels or vertical or inclined shafts are dug from the surface to the substance to be mined. Tunnels are made especially where the ore body lies in the side of a mountain. Tunnels form the best method of mining, for conveying ore horizontally out of a tunnel is much cheaper than hoisting it up through a shaft, and by having the tunnel on a slight incline drainage or pumping expenses are curtailed. In the middle western United States, it is common to see the mouths of mines leading into the sides of hills, like dirty yawning caves, with some mine light glimmering faintly in the black interior.

When a shaft is sunk, tunnels called "drifts" and "crosscuts" are dug sidewise from it at different levels and in various directions into the mineral seam. Thus an elaborate mine is like an underground city, with an orderly arrangement of streets and alleys, though not all on one level. Some mountains, particularly in the western United States, are honeycombed with such underground workings. Where practicable these passageways are made to slope down a little toward the mouth of the tunnel or toward the central shaft so that the water may flow out of the tunnel, or water in the mine may drain into the sump or pool at the bottom of the main shaft, whence it is pumped out. The different levels of a mine are connected by auxiliary vertical shafts or "winzes." The ore between the various openings is said to be "blocked out." (*See* Copper for description of shaft and equipment.) Ventilation is accomplished in shallow mines by an air shaft. In deeper mines large rotary fans or blowers, driven by steam or electricity, are used to force fresh air into the far corners of the mines.

Mine buildings, constructed frequently of galvanized iron, with towering pipes and smokestacks, resemble great mills. A huge building is erected over the mine entrance in many cases. Often separate buildings are constructed for the mining machinery, engineers' offices, labor quarters, and explosives, etc.

Now let us visit a coal mine to see how it is worked, since coal mines have much in common with all underground mines. Unless the mine is lighted by electricity, the grimy miner wears attached to his small cap a little safety lamp, his only light in a world of blackness (*see* Davy, Sir Humphry). He is carried down into the depths of the pit by an elevator-like hoist called a "cage," passing the various levels just as you pass busy floors in a factory elevator. Following the main tunnel at the level on which he is to work he passes through a branching gallery until he reaches the black shiny wall of coal called the "working face." Then, perhaps lying on his side, he begins to break down the coal. He uses a pick, a shovel, a steel rock-drill—driven by steam, electricity, compressed air, or even a hand hammer—and various pneumatic or electric cutting and digging machines, such as the "undercutter," which undermines a ledge of coal by means of an endless chain in which knives travel around in a frame. Such machines are often mounted on rails, being moved along from place to place as the cutting proceeds.

The drill is employed chiefly in blasting. The miner drills small "bore holes" in the coal and inserts charges of black powder, which are touched off with an electric current. A muffled roar, and the coal in the face of the mine crumbles, the coal falling down in great chunks. As the coal is removed the mine roof is supported by leaving pillars of coal at intervals, or by using timbers, for one of the greatest of mine terrors is the danger of having the roof cave in. Cave-ins were once common, and entombed hundreds of miners. But safety laws and the work of safety engineers have considerably reduced accidents (*see* Safety).

How the Coal Reaches the Surface

The miner next sorts the coal and loads it on small trams or dump cars on tracks. The cars are hauled to the main shaft by compressed air or electric locomotives, or by mules and horses, the animals being quartered in subterranean stables and living their entire life in the mine, rarely or never seeing daylight. In China, Mexico, and South America ore is still carried on men's backs.

Hoists, called "skips," convey the coal up the main shaft to the top of the breaker house at the mine mouth, where it is dumped down chutes into the "breakers"—an assemblage of screens and chutes—which sort the coal into various sizes and grades. From the breakers the coal falls into bins or dumps and is ready to be taken to market.

In ore mines, other processes take the place of the coal breaking. In many cases the masses and lumps of ore, after being brought to the surface, are crushed, or even ground to powder, often by the pounding of huge hammers in a stamp mill. The valuable part of the ore is then separated from the waste, the process of separation being different in different cases. Where the ore is much heavier than the waste, the separation is brought about through differences in specific gravity. The final extraction of the metal, like the preliminary treatment of the ore, differs with the nature of the ore.

The importance of mining and the dangers threatening miners have led the United States to create

a Bureau of Mines in the Department of the Interior. This unit was organized in 1910. It was transferred to the Department of Commerce in 1925, and returned to the Department of the Interior in 1933.

Work of the Bureau of Mines

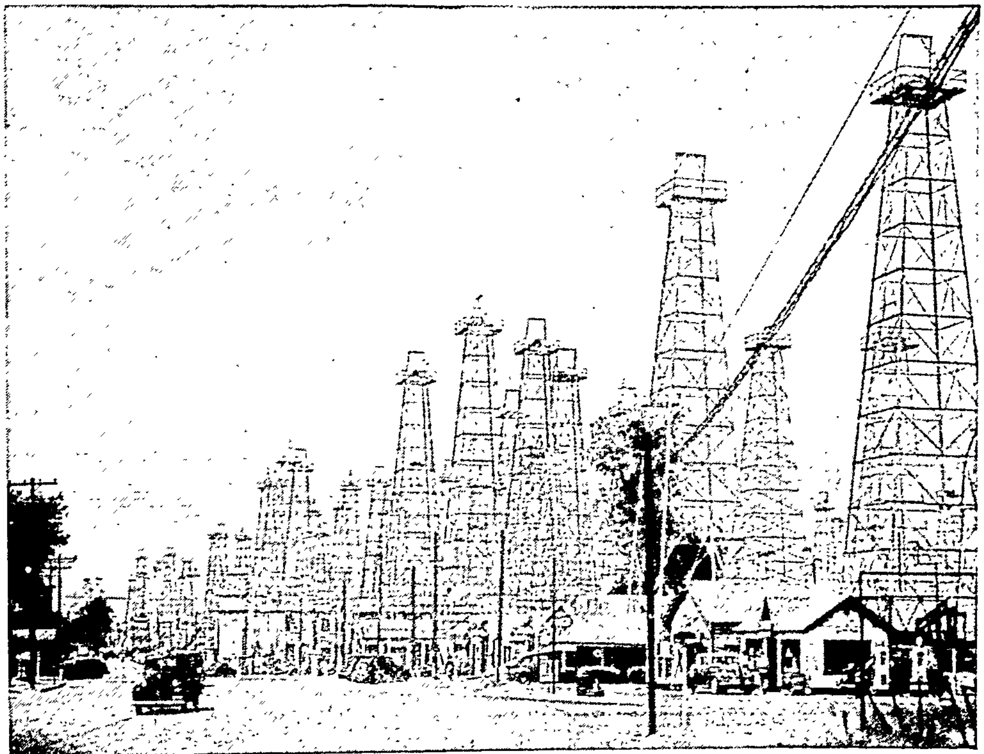
The Bureau of Mines is charged with aiding the development and operation of the mineral industries of the United States. It explores for new mineral deposits and makes tests of samples. It studies new mining and milling methods, and conducts experimental mines to develop effective methods of extracting various ores.

This agency is the only commercial producer of helium gas in the world. It operates helium plants that supply the gas for blimps and balloons, and for industrial and scientific purposes. So important is helium as a strategic material that Congress passed the Helium Act of 1937 to control production and sale.

The Synthetic Liquid Fuels Act of 1944 granted funds to the Bureau of Mines to conduct research in deriving gasoline and other liquid fuels from coal and shale. This important work is expected some day to guide industrial production when petroleum reserves are exhausted.

A major function is the promotion of health and safety in mines. The Bureau trains mine workers and officials in accident prevention, mine rescue, and recovery work, and publishes data on mine casualties. It tests new rescue devices and analyzes dangerous powders, dusts, and spark-emitting equipment.

OIL CHANGES THE FACE OF A TOWN



Sleepy towns are transformed almost overnight when oil is discovered underground. Derricks rise along business streets and in back yards, and loom against the sky like giant steel skeletons. This street is in Kilgore, Tex., one of the richest oil areas in the world.

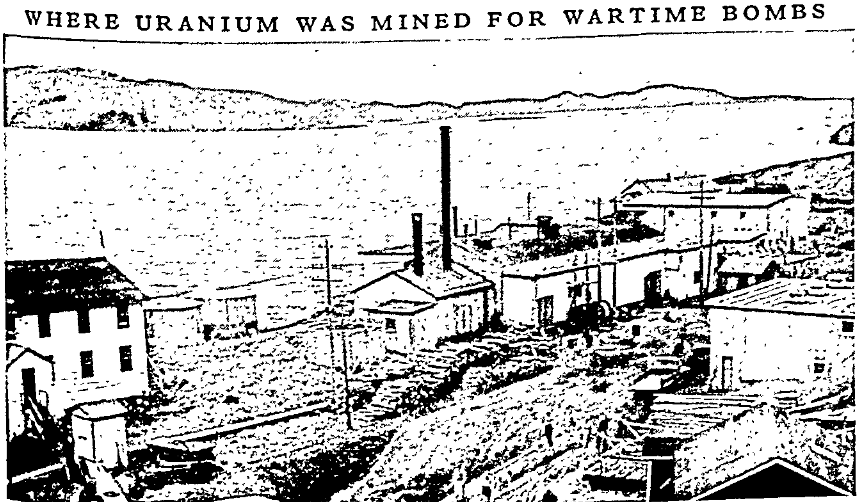
Mining and History

Minerals are so important in the history of human development that stages of progress have been named for them. The Stone Age marked the time when men fashioned stone weapons and implements. Even then they burrowed underground to gather the best quality flints. The first metal that men learned to mine and shape was copper, and the Copper Age began with its use. At first they dug the ore from outcropping veins in surface rocks. But soon they began to go underground for copper. The copper mines of Sinai, worked as early as 5000 B.C., are the oldest metal mines known.

The Bronze Age was born when men found that a union of copper and tin produced a stronger and more durable metal. It was supplanted by the Iron Age, a thousand years before the Christian Era began. Our own time may be termed the Age of Steel.

All through history mines helped shape the course of national growth. The Phoenicians crossed the Mediterranean to work the copper mines of south-

WHERE URANIUM WAS MINED FOR WARTIME BOMBS



During the second World War, Port Radium on the shores of Great Bear Lake near the Arctic Circle buzzed with boom-town activity. This small village was a center of pitchblende mining; and from the ore came uranium for the wartime atomic bombs.

ern Spain, and their intrepid seamen sailed to Britain to trade for tin. Egypt under the pharaohs was a strong nation because of its copper mines. Spain conquered Mexico and Peru and rose to greater power with their riches in gold and silver. Britain's coal mines and production of iron and steel provided the basis for the Industrial Revolution which created the modern machine age. In America, the rush for gold

THE COAL FOREMAN WORKS NEAR HIS MEN

The foreman's "office" in a coal mine is located several hundred feet below ground, near the level where the miners are working. Walls and ceilings are supported by heavy beams. This foreman and his assistant wear miners' helmets and lamps.

in California, led the '49ers to push the western frontier clear to the Pacific. Today coal and petroleum play vital rôles in international politics, and nations are competing over diplomatic tables for uranium ore to supply atomic energy.

In modern times, the development of Saudi Arabia is a dramatic story of how a mining industry transformed a barren waste into a thriving land. In the middle 1930's this country was mainly desert. The nomadic peoples followed their herds from oasis to oasis and lived nearly as they had for the past 2,000 years. But the petroleum wealth under the desert sands was wanted by western nations.

As men and money poured in to develop the oil industry, a vast program of public improvement began. They built roads, harbors, irrigation projects, and railroads. Towns sprang up; and with them schools, hospitals, air fields, power systems, and extensive health and sanitation measures were launched. The wages of native laborers increased about three times. Thus oil almost singlehandedly created the start of a modern nation (*see* Arabia).

In the United States, as elsewhere, cities grew up around mining districts and rose to manufacturing or shipping leadership. Galena, Ill., and Green Bay, Wis., had their starts with lead mines. Denver, Colo., and Butte, Mont., were frontier silver- and gold-mining towns. Tulsa, Houston, and Oklahoma City prospered with oil. Birmingham, Ala., and Pittsburgh trace their importance directly to coal and iron mines. Such lake cities as Chicago, Cleveland, Erie, and Duluth owe part of their growth to their rôles as ore-handling ports. So important are mines and the industries that they supply that more than half the people of the United States live within a hundred miles of the eastern and central coal fields.

Private fortunes too were founded on minerals The great wealth of the Fugger family, German capitalists of the 16th century, came from the silver and lead mines of Styria, the Tyrol, and Spain. In America, the Rockefeller millions came from petroleum, and the Mellon fortune from aluminum. Other men gained riches from the mining of precious stones Notable among these was Cecil Rhodes, whose money came from South African diamond mines

Mines and Men

In ancient times, mining was considered degrading toil, and the work was done by slaves. Many of their tunnels, furnaces, and primitive mining tools still exist. To shatter rocks, they set fires in the cracks, then dashed cold water on them. They used sieves for concentrating the ore and had fairly efficient smelters.

Drainage was a continuing problem until the 18th century. The Egyptians bored slightly inclined tunnels called *adits* to let the water seep away. The Romans adapted Archimedes' screw pump for raising water and provided power with a water wheel. But none of these worked well, and we owe the invention of the steam engine to the search for a better means of pumping water from coal mines. Savery and Newcomen worked on the problem, and James Watt finally solved it with the first practical steam pump (*see* Watt).

Technological improvements were slow as long as plenty of slaves could be found to work in the mines In many ancient countries, mining was actually considered a form of punishment reserved for the most unruly captives. Not until the late Middle Ages did free men go down into the mines. Even then, working conditions were extremely bad, and remained so for several centuries.

Work in the Early Coal Mines

The lot of the coal miner was especially bad. Although the miner lived close to the mine, it took him a long time to get to work. He had to travel, often by crawling, through narrow and winding passages until he reached the place where he would work that day. Thus his work day started before dawn and ended after dark.

Once at work he sat all day with his legs spread out before him or lay on his side in the narrow chambers, digging out coal with a hand pick. Water dripped down on him and covered the floor where he sat or lay. His only air was what seeped through cracks. He loaded his coal in carts or even baskets, and these were dragged to the surface by women and children.

At any moment the miner might be buried under tons of falling rock or coal unless the walls and roof were strongly supported by timbers. Gas seeping from the seams brought a double danger. Odorless, it could kill him before he detected its presence. It was highly explosive and a chance spark could cause a swift explosion that sealed off any chance of escape. Mining was the most hazardous industry in the world, and coal mining the most dangerous of all.

Living conditions were equally bad. The mine operator, unlike the manufacturer, had to go where coal deposits existed, and the miner had to live near the mine. In pioneer days in America the miners merely camped around the mine shaft. These camps grew into "company" towns, populated solely by miners and their families.

Typical coal-mining towns were a long distance from metropolitan centers. Boxlike, unsightly houses, some mere shacks cheaply clapped together, sprawled in all directions or huddled on the sides of hills. There were no baths or toilets, nor paved streets and sidewalks. The only local government was that of the company, since the whole town was its private property. The company spent as little as possible, because building and improvements in such rugged country was costly. Desire to make as much money from invested capital and the general uncertainty of mining operations also contributed to lack of interest in miners' welfare.

The company operated a store where miners' wives did all their buying. They also provided a doctor, the only medical service in the town. A system of "check-offs" or wage deductions was established as payment for these goods and services. Sometimes wages were paid in "script," good only at the company stores.

These conditions existed in varying degrees in most mining industries, with the exception of petroleum. Alleviation did not come until a growing national conscience brought reformation in all mining and manufacturing. Since the coal-mining industry led in reforms, the story of this improvement is told largely in the article on Coal.

How the Modern Miner Lives

The American miner comes from all over the world and represents all races. The highest number of foreign-born workers are found in Pennsylvania. In the West there are mining camps made up wholly of Mexican-American, Japanese-American, or American Indian miners. Large groups of southern miners are from Scotch-English families who settled there several generations ago. All mine workers are men. During the second World War, a few women were employed in surface tasks, but they were not welcomed by the miners.

Whatever their national origins, miners today have common interests with most Americans, and live in much the same way. In the old days, they remained aloof and clannish; and son followed father into the mine. The same jobs passed from generation to generation, and few ever broke away from mining.

Decrease in the Mining Population

Today the chain that bound the miner and his son and grandson to the mine is broken. A steady flight from mining industries has been taking place. Since the 1920's the number of workers in all mining industries except petroleum and natural gas has decreased steadily. Few younger workers have replaced older men; thus the average age of miners has increased. Despite this, mineral production has continued to meet growing demands. Greater efficiency and mechanization have thus far more than offset any result of the shrinking mining population.

State employment laws partly account for the decrease. A boy who grows up in a mining town cannot start work in the mines until he is 17 years old. Meantime he gets a high-school education and other fields of employment are thus open to him. These may

WHERE COAL MINERS CHANGE THEIR CLOTHES

Coal miners going on and coming off the job change their clothes in the "wash" or "shift" house. They leave their work or street clothes hanging out of the way near the ceiling. They use these open hangers in preference to lockers in order to let their work clothes dry out overnight.

offer higher wages and more comfortable living and working conditions. Miners themselves have left the mines because other industries have bid for their labor.

For those who have remained in mining, conditions have improved vastly. The company town still exists, but it no longer controls the miner's life. Independent stores compete with the company store, and all offer goods at fair prices. Company-owned houses have been modernized or replaced, and miners are encouraged to own their own homes. Hospitals, high schools, good roads, and other community services compare favorably with those of other American towns and cities.

Working Conditions Improved

The back-breaking toil once characteristic of mine work is disappearing. Pneumatic drills, mechanical loaders, electric cutters, conveyers, and hoisting machines make work easier. Complete mechanization is the goal of all mine operations. Miners welcome new devices, for more efficient production means greater profits, from which they can claim a larger share.

CHECKING AIR CIRCULATION IN THE MINE

This coal-mine inspector is measuring the speed and volume of fresh air passing through the mine tunnel. The measuring device, watchlike in shape, has a small revolving disc and recording counter.

in comparison with the others.

Safety helmets and safety shoes are worn by every miner at work Safety lamps detect the presence of dangerous gases, and constant inspection is made of supports for roof and walls. Modern air conditioning provides pure air and regulates temperatures. One of the largest of these air-conditioning plants is installed in a South African gold mine.

With good drainage and control of moisture, rheumatism—once the miner's chief health hazard—is on the decline. Until recently, lung diseases from breathing in dust were serious and common ailments. Filtering masks have done much to alleviate sicknesses.

Safety laws and methods have brought a steady decline in accident rates, although mining is still the most dangerous of all industries. Cave-ins or rock falls are the major sources of mine casualties. Drilling is the most dangerous work in the petroleum industry, but this type of mining has a low accident rate

But the greatest improvements in the mining industry are to be found in wages and benefits. Wages for metal miners match those in the building trades. Oil workers' wages are high, and oil companies have well-organized employee benefit plans. Coal miners earn more than factory workers of comparable skill. The United Mine Workers of America (UMW) was the chief bargaining agent of the coal miners in securing their gains (*see* Coal; Labor).

MINERS' WIVES BUY GROCERIES ON CREDIT

At the company store, or at one of the privately owned competing stores, miners' wives trade on credit and pay bills when their husbands receive their pay envelopes. During slack seasons, bills sometimes mount up; but miners are good credit risks.

Mining Engineering

Like other complex technologies, the mining industry needs trained engineers to plan and supervise all phases of the work. These men must have bachelor's degrees in mining engineering or in some related engineering field as civil, mechanical, or metallurgical engineering, or in geology. In a few cases, a man can qualify as a mining engineer without college training, if he has long years of professional experience which fit him for the work.

The mining engineer may specialize in prospecting. This involves work much like that of a geologist. He locates the mineral deposit and determines its formation and nature. From these he judges whether the mineral can be profitably mined. He

must use drilling equipment to take samples and calculate reserves by geophysical methods. He must also know how to assay the ore.

Another specialized phase is developing the mine, cut, or quarry for production. The engineer plans the location, size, and type of shafts and other openings. He supervises the design and installation of water supply, power, and ventilation equipment, as well as transportation in the mine. He also supervises the design and installation of ore-treatment equipment.

The engineer in charge of production is responsible for training and safety of workers, maintenance of equipment, and quality of the product. He must also develop unworked mine property.

Other opportunities exist in research, teaching, and selling mine equipment. Experienced mining engineers also act as consultants to investment houses and banks interested in mining properties.

AN ARISTOCRATIC FUR BEARER

This picture of a northern mink of the American species shows why women like mink coats. The fur is thick and richly colored and has a beautiful sheen. It is as durable as it is beautiful. The animal is somewhat darker and glossier along the back and tail, and the chin is light. There may be scattered white spots. The mink does not change color in the winter.

MINK. One of the most popular and luxurious furs worn by women comes from the mink. This is a long-bodied slender brown animal related to the weasel and the marten. It is found in widely scattered regions of North America, from the Gulf of Mexico to the Arctic Circle, and in northern Europe and Asia. The American mink is about two feet long including its eight-inch bushy tail. It has small ears, a long neck, and short legs. Its fur is thick and soft with long stiff, shiny guard hairs. These are plucked out by the furrier. The minks of northern regions have the darkest colored and most lustrous fur. The European species is somewhat smaller than the common American mink. It is also distinguished by its white upper lip. The Siberian mink has a tawny brown fur.

The mink lives along the banks of streams and ponds in the woods or on the plains. It is a skillful swimmer and diver, and hunts its food both in water and on land. The mink is fond of birds and sometimes climbs trees to rob nests. It also eats frogs, fish, lizards, and grubs. In winter the swift little animal chases rabbits and muskrats over the snowy ground. It is wonderfully agile in spite of its short legs and can elude almost any pursuer. When cornered, a full-grown mink is a foe to be reckoned with. It fights fiercely and gives off a strong disagreeable odor.

The young begin life in a nest prepared in a hollow log or in a hole among rocks. There is only one litter a year, with usually five or six young, although there may be from three to ten. The natural life span of the mink averages five to six years.

Mink raising on fur farms is a growing industry in Europe and America. It pays well, and the animals are not hard to raise. A mink coat is expensive, for the average full-length garment takes from 60 to 70 skins. Mink farmers have used scientific breeding to develop black, white and black, platinum, and silver-blue mink. "Japanese mink" is the yellow-brown fur of the Itachi weasel, dyed dark brown.

Scientific name of the American mink, *Mustela vison;* of the family, *Mustelidae.* There are many sub-species. The European mink is *Mustela lutreola.*

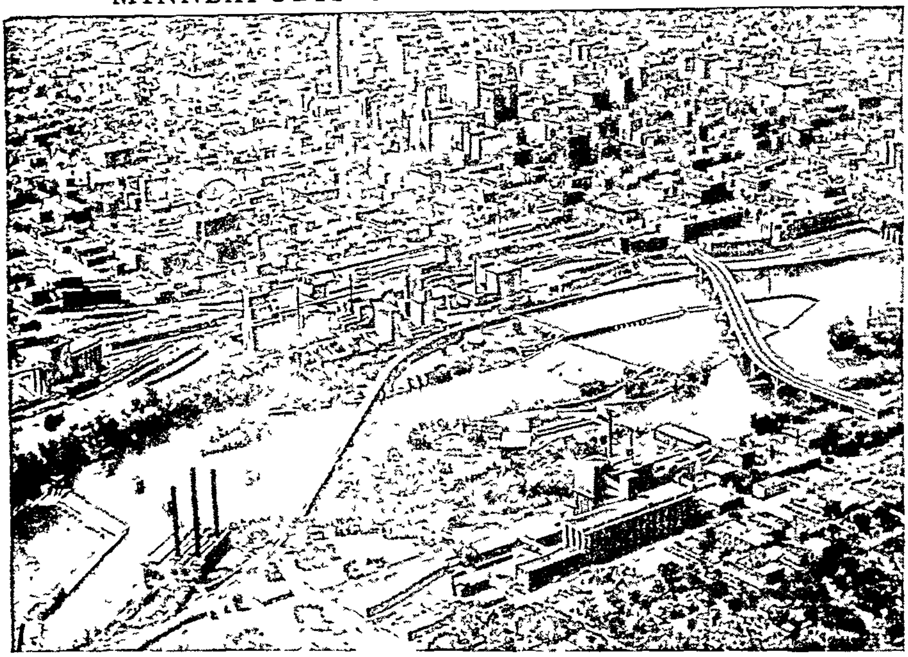
MINNEAPOLIS, MINN. Grain elevators and flour mills dominate the sky line along the Mississippi River at Minneapolis. This city, the largest in Minnesota, is a great market place for the wheat farmers of the Upper Midwest and is one of the nation's chief flour centers. Its grain elevators can store more than 90 million bushels of grain. This makes it first among the nation's cities in grain terminal storage. Its mills can grind more than 7 million pounds of flour daily. Hydroelectric plants at the Falls of St. Anthony in the Mississippi supply the flour mills and have been a factor in the city's industrial growth.

Sawmills provided the city's first industry. Lumbermen in northern Minnesota could float their logs directly to the mills that clustered about the Falls of St. Anthony. As the Minnesota forests gave out, sawmills yielded to flour mills. Today the city manufactures many products, including linseed oil, dairy products, bread and bakery products, furniture, clothing, foundry and machine-shop products, forest products, and many kinds of machinery.

Ten trunk railway lines enter the city and make it a distributing center for the Upper Midwest. It is the seat of the Ninth Federal Reserve Bank.

Minneapolis is a city of homes on wide, shady streets. Many lakes, with sandy beaches for bathing, lie within its borders. Parks cover 15 per cent of the city's area. Boulevards link parks, lakes, creek lands, and river bridges into one great system.

MINNEAPOLIS SPANS THE MISSISSIPPI



The Mississippi River winds through downtown Minneapolis. Bordering both sides of the river at the Falls of St. Anthony (right) is the milling district with its giant flour mills and grain elevators. Towering in the background is obelisklike Foshay Tower.

Minneapolis has attained distinction as a center of culture. It is the home of the University of Minnesota, of several denominational institutions of learning, and of the Dunwoody Industrial Institute, a large endowed trade school. The Institute of Arts and the Walker Art Center contain fine collections of art works. The Minneapolis Symphony Orchestra, maintained by public subscription, is known to music lovers throughout the United States. The orchestra gives its concerts in Northrop Memorial Auditorium at the University of Minnesota. This building also has galleries to house the university's collections of art and temporary exhibits.

Minnehaha Paık is the site of the Minnehaha or Laughing Water Falls immortalized by Longfellow in 'Hiawatha'. Here Minnehaha Creek falls 53 feet over a limestone ledge as it flows toward the Mississippi. Lake Minnetonka, 17 miles southwest of the city is one of the great summer resorts of the area.

Louis Hennepin, a Franciscan missionary, discovered and named the Falls of St. Anthony in 1680. The name Minneapolis comes from the Sioux word *minne* (water) and the Greek word *polis* (city). St. Paul adjoins Minneapolis for half its length on the east. Population (1950 census), 521,718.

INEXHAUSTIBLE RICHES *of the* "GOPHER STATE"

MINNESOTA. Gold is precious, but iron and bread are indispensable. So far as products go, the world needs Minnesota even more than Minnesota needs the rest of the world. Minneapolis is one of the world's greatest flour-milling cities. Flat and rich wheatlands of black soil lie in the valley of the Red River of the North, which runs through western Minnesota. The most productive iron mines in the world are in the Mesabi Range in the northeastern corner of the state. Almost as important as mining for income is the tourist trade. In 1950 the state attracted about one million visitors who spent some 2 million dollars.

With no coal and greatly reduced timber, the state has little fuel. Minnesota, however, is restoring its forests with a conservation program. Another enormous resource, water power, awaits development.

Features of the Land

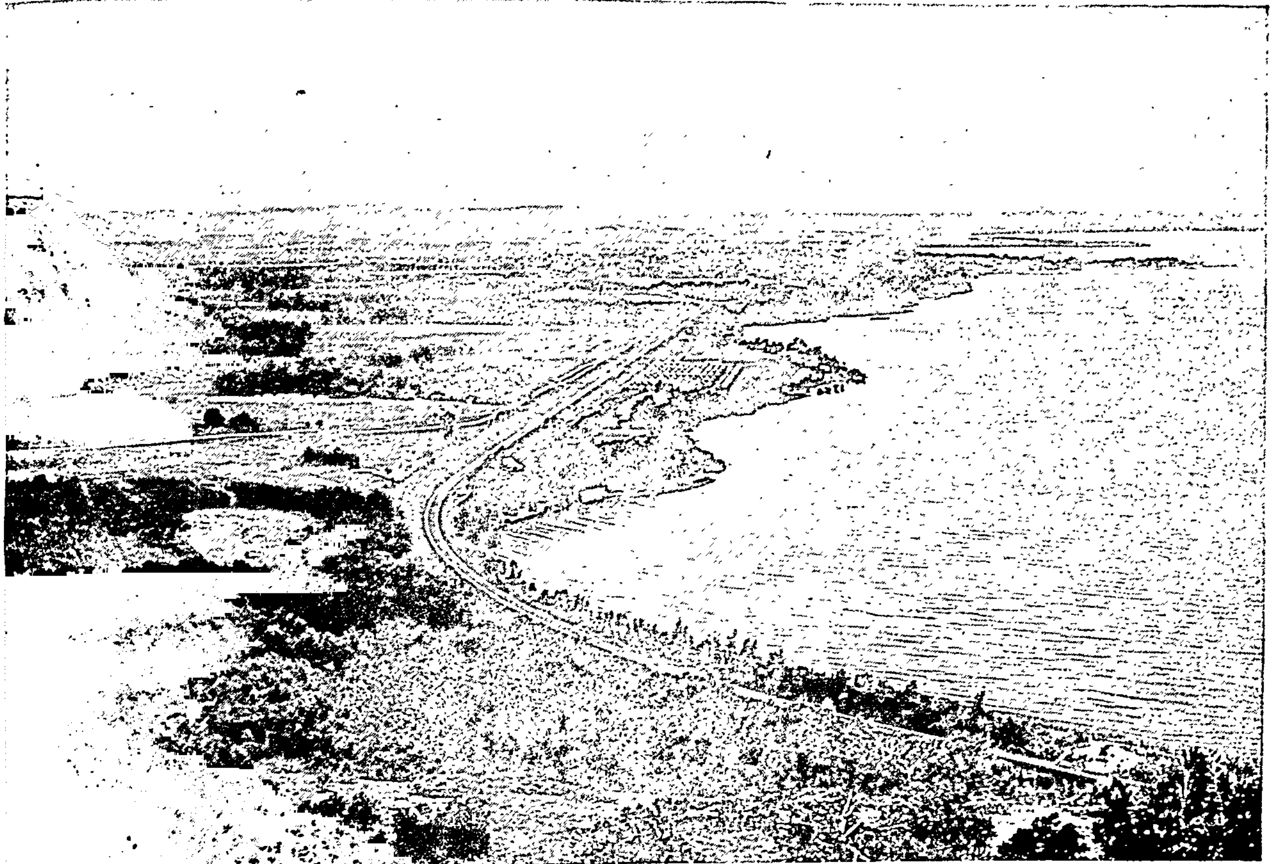
Neighboring states exceed Minnesota both in average and maximum elevation. Yet, long ago, angry volcanoes towered in this region, erupting from time to time and ejecting lava that spread for many miles. The lava belched forth by Vesuvius is nothing compared to the lava-covered area of Minnesota.

Battered and rasped for ages on ages by wind and rain and running water and slowly grinding glacier, only the flattened stumps of these ancient mountains now remain. Still, the highlands of the north central part of Minnesota, seamed with volcanic rock, form a watershed whence water flows to the ends of the continent—into Hudson Bay through the tributaries of the Rainy River and the Red River; into the Gulf of Mexico through the Mississippi and its tributaries; and into the Atlantic Ocean through the St. Louis River, the Great Lakes, and the St. Lawrence River. From this highland the rolling plain slopes in all directions to rise again as the Misquah Hills in the northeast and as the Côteau des Prairies in the southwest. The northernmost point of the nation is the peninsula Northwest Angle in Lake of the Woods.

A Land of Lakes

In the Dakota Indian tongue "Minnesota" is said to mean "sky-tinted water." Dotted with thousands of little lakes—more numerous, probably, than any other state can boast—and threaded with streams frolicking in many a waterfall, the state is like a water-soaked sponge. About one fifth of the surface is swamp land, capable of being drained and exceedingly rich and productive after drainage. The annual rainfall is light, but owing to the amount of moisture in the soil and the fact that most rains occur when

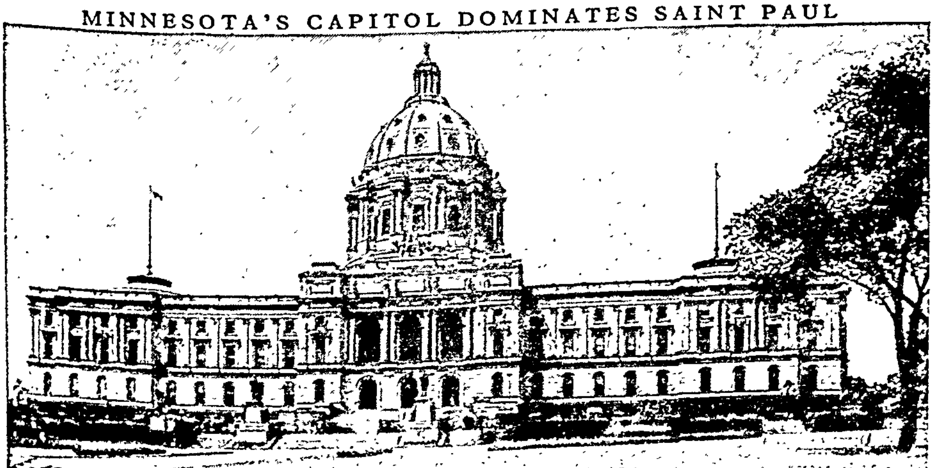
A BEAUTIFUL DAUGHTER OF THE "FATHER OF WATERS"



Lake Pepin, thirty miles below St. Paul, is really only an expansion of the Mississippi across its flood plain. This great work of Nature's art was produced away back in the Ice Age when the Chippewa River, flowing into the Mississippi from the east, brought down loads of pebbles, sand, and boulders from the melting glaciers, and poured them into the Mississippi. This checked the waters and caused them to widen out into this beautiful mirror of sky and clouds.

they are needed in the growing season, it is ample for splendid crops. Drought is almost unknown. The expanse of water and the moisture in the soil modify to a certain extent the sudden violent changes in temperature, to which dry inland regions are subject. The snow that blankets the ground throughout the winter is an additional protection to the vegetation, which grows with marvelous rapidity in the spring. Lakes, swamps, and the rich dark brown or black sandy soil itself are all a heritage from the great glaciers which, several times during the Ice Age, flowed over practically the whole of what is now the state of Minnesota. Here and there they scoured out basins for water to collect in, and everywhere they scattered the glacial drift. As the last glaciers receded from what is now the valley of the Red River of the North, their melting waters formed a vast lake (called by geologists Lake Agassiz) larger than any of the Great Lakes today. The alluvial mud left by this vanished lake makes the valley one of the world's granaries, containing the richest wheat lands of Minnesota, North Dakota, and Manitoba. (*see* Red River of the North.) In most years of normal harvests, Minnesota is one of the country's important states in production of spring wheat.

MINNESOTA'S CAPITOL DOMINATES SAINT PAUL



From its commanding location on a high hill the capitol of Minnesota overlooks the business section of St. Paul. This splendidly proportioned structure can be ranked among the most impressive state capitols in the Union. It is built of native granite enriched with white Georgian marble.

Corn is now the leading farm crop of Minnesota. The two tiers of southern counties, it has been said, might be mis-

taken for the great corn-growing counties in Iowa or Illinois. Oats are grown throughout the state, and in total production of this grain Minnesota is second only to Iowa. Hay is also an important crop, especially in the central region. Minnesota leads all states in growing flaxseed, raising as much as 19 million bushels in a year.

Much of the grain and hay is fed to livestock. Sales of hogs, cattle, dairy products, chickens, and eggs contribute to the state's farm income.

Great Iron Ranges

The rugged northern part of the state contains three famous iron ranges—in the northeast the Vermilion and Mesabi, and just north of the center, the Cuyuna. The ore is easily worked hematite. The Mesabi Range is the most important part of the famous Lake Superior ore district. It is partly responsible for American supremacy in the world's iron and steel market. Some of the ore is used near Duluth, but most of it is shipped from there and other lake ports to the mills of Illinois, Ohio, and Pennsylvania (*see* Duluth). In some years almost 70 per cent of the iron ore mined in the United States has come from Minnesota. Three fourths of the output comes from the Mesabi Range. The state also has reserves of taconite, a low-grade ore. Methods of smelting it have been developed to safeguard against exhaustion of hematite (*see* Iron and Steel).

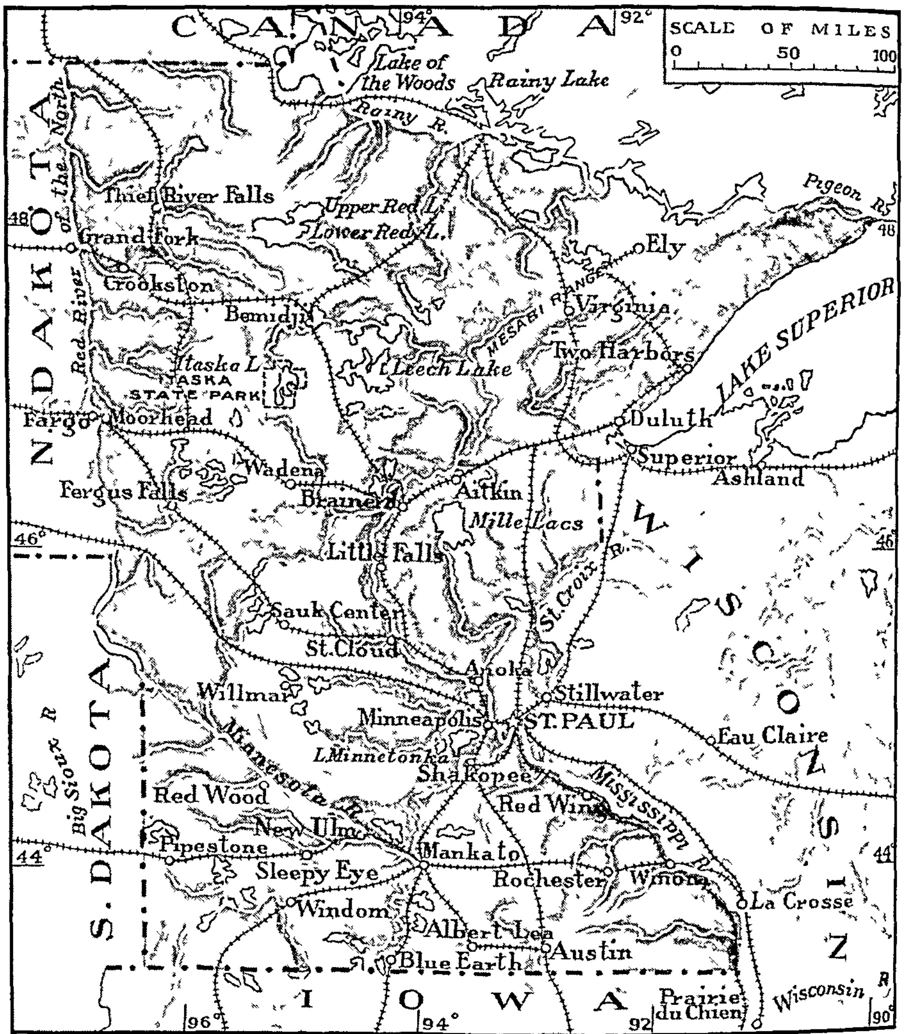
Building stone (granite, sandstone, and limestone), sand and gravel, cement, manganiferous ore, marl, lime, abrasive stones, and clays are other important minerals. The red pipestone from which the Indians made their pipes was quarried near what is now Pipestone, in the southwest corner of the state.

Mills and Meat-Packing Plants

Water power and raw materials produced within its borders—breadstuffs, livestock, and iron ore—are the basis of the state's largest manufactures. Ever since Minneapolis rose to greatness as a flour-milling center, flour and other grain-mill products have been important. Since the peak years of production during the first World War, it has been cheaper to mill flour near principal markets. Buffalo has now become the world's greatest milling center. Minneapolis is third after the combined total of Kansas City, Mo., and Kansas City, Kans. While milling declined, meat packing increased until its value now exceeds manufactured food products. South St. Paul rivals Omaha as a packing center (*see* Minneapolis; St. Paul).

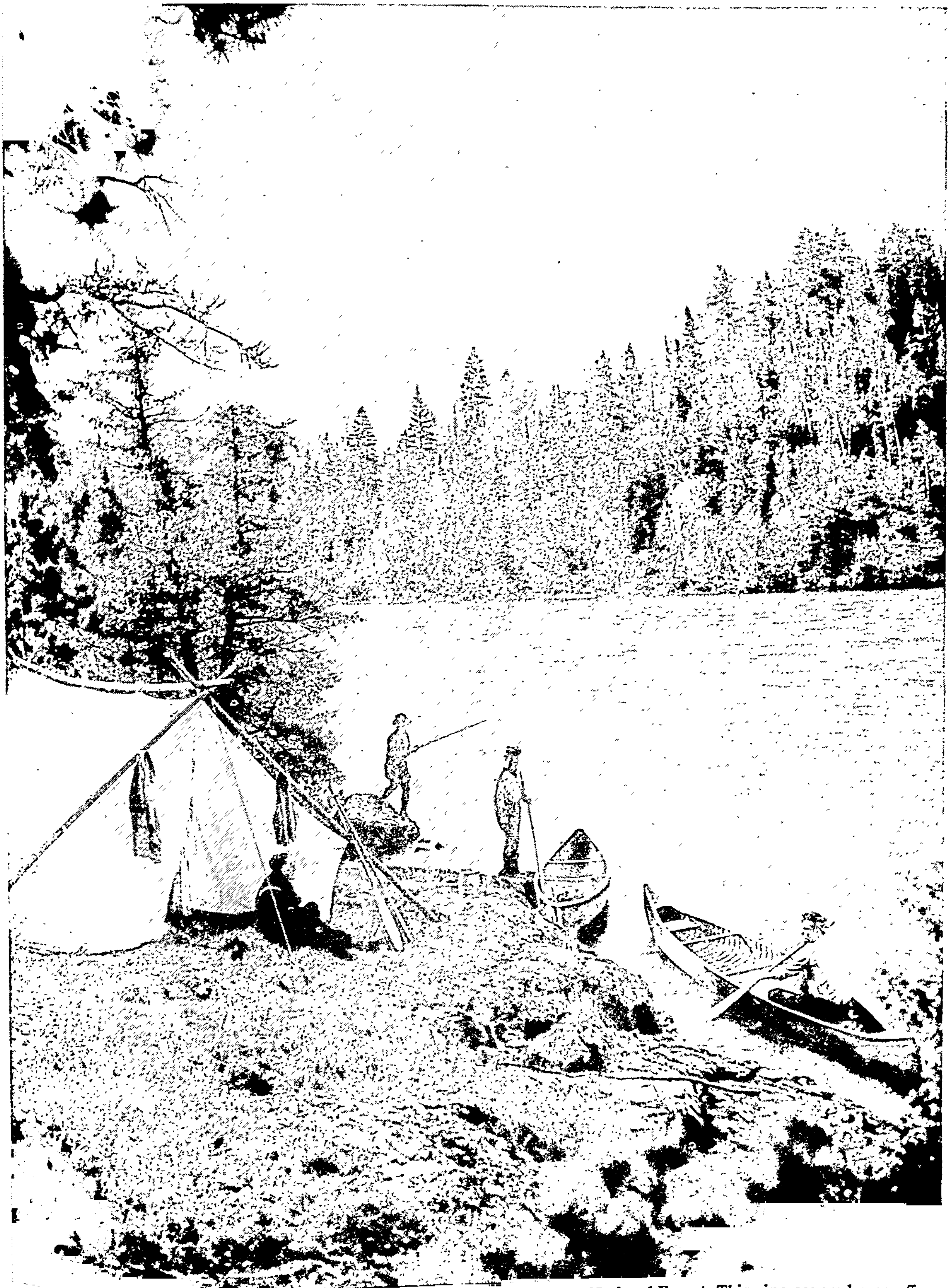
Minnesota makes more butter than any other state. It also leads in the production of linseed oil in the United States. Lumbering and the manufacture of lumber products, once the most important of Minnesota's industries, have lost their former high rank because the forests have been thinned out. Today the manufacture of machinery ranks second only to the production of foodstuffs. This machinery includes tractors, refrigeration equipment, construction and mining equipment, and electrical-control apparatus. St. Cloud is one of the country's principal centers for the quarrying and processing of granite for buildings and monuments. Rochester, Minn., the seat of the

STATE OF FLOUR, CATTLE, AND IRON



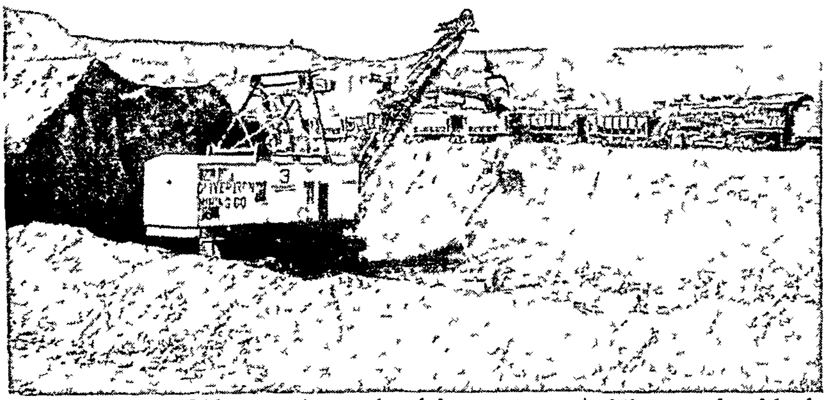
Minnesota's lake-fed rivers provide abundant power for its mills and offer a superb summer attraction for visitors. Lake Superior affords an outlet for iron ore and grain.

A CANOE TRIP IN A SPORTSMEN'S PARADISE



Here a fishing party camps on the shore of one of the 2,000 lakes in Superior National Forest. This pine-covered area offers plentiful facilities for outdoor recreation. Federal laws have preserved the primitive beauty of the forest just as the Indians and early explorers found it. Superior National Forest lies in the northeast corner of Minnesota on the Canadian border. Canadian Quetico Provincial Park adjoins it on the north. This area too has been preserved as a roadless wilderness.

OPEN-PIT MINING IN MESABI RANGE



At this mine near Hibbing an electric shovel digs iron ore out of the ground and loads it directly onto railroad cars. *From here the ore is shipped to blast furnaces to be* melted into iron. Minnesota mines more iron ore than all the other states combined.

Mayo Clinic (now affiliated with the University of Minnesota) is as famous among the surgeons of the world as Minneapolis is among the millers.

State Owns and Leases Iron Mines

Thirty-five of the iron-ore mines are state owned and leased to operators. Royalties paid from mines on school lands, together with money from the sales of the lands and timber products, have made the Minnesota school fund one of the richest in the Union. The fund permits the state to offer attractive salaries to teachers. The largest open-pit iron-ore mine in the world is at Hibbing. The community has been called "the richest village on earth." Revenue from the mines helps support a fine elementary- and secondary-school system and a junior college. The state university at Minneapolis (and Duluth) is one of the foremost state universities in the country.

Minnesota's constitution was adopted in 1858. The executive department consists of a governor, lieutenant governor, secretary of state, treasurer, auditor, and attorney general, elected for two years, excepting the auditor, who serves for four years The commissioner of administration is appointed by the governor.

Minnesota has a high proportion of foreign-born population for an agricultural state, mostly Scandinavians, Germans, Finns, and Canadians. These hardy, thrifty northern stocks found congenial conditions here and did much to build the state.

Early History of Minnesota

The white man found Dakota Indians, a division of the Sioux, living in the forest regions of what is now Minnesota. Some of the Dakotas lived in villages alongside pine-edged lakes. All of them hunted and many grew crops. But they were being driven out by the Chippewas. These were Algonquian Indians who had pushed westward from Sault Ste. Marie. Armed with white men's guns, by 1750 the Chippewas had driven the Sioux from the forests onto the plains.

Two white men from New France had visited both shores of Lake Superior by 1660. They may even have gone inland to the Mississippi. These men were Pierre Esprit de Radisson and his brother-in-law, Medard Chouart, the Sieur des Groseilliers. They were explorers and fur traders (*see* Furs and Fur Trade).

In 1671, Sieur de St. Lusson, a member of the government of New France, held a great pageant at Sault Ste. Marie and claimed the unknown "country of the West" for Louis XIV. French explorers pushed north and west of Lake Superior, hunting for a northwest passage to the western ocean. French fur traders established canoe routes over lakes, rivers, and portages. They built trading posts and forts.

In the French period, Daniel Greysolon, Sieur du Lhut (or Duluth), explored the region above the west end of Lake Superior and that between the Mississippi and St. Croix rivers (1678-89). Father Hennepin went up the Mississippi in 1680, was taken captive by the Sioux, and was rescued by Du Lhut (*see* Hennepin). Pierre le Sueur built a fur-trading post on Prairie Island in the Mississippi in 1695. In 1731 Sieur de la Vérendrye and his relatives explored the canoe route from Pigeon River to Rainy Lake.

Britain Dominates the Scene

The Treaty of Paris ended the French and Indian War in 1763, and brought what is now eastern Minnesota under the British flag. France had ceded the area west of the Mississippi to Spain the year before. Spain had lost it to Napoleon in 1802, and the United States bought it as part of the Louisiana Purchase in 1803, subject to dispute about the Red River drainage basin. This was settled in 1818.

In 1766 Jonathan Carver, of Connecticut, went up the Mississippi from Prairie du Chien to the Minnesota River. He spent the winter with a band of Sioux and in the spring explored the north shore of Lake Superior. Peter Pond, a Connecticut Yankee, traded with the Sioux on the Minnesota in 1773-74. The next year he went from Grand Portage over the northern canoe route to trade farther north and west.

The rivalry among Scottish and English fur traders often led to guerrilla warfare. In the late 1770's, a number of Scotchmen combined to form the North West Company. The Hudson's Bay Company entered the region in 1793 (*see* Furs and Fur Trade).

United States Expels British

In 1816 Congress passed an act prohibiting foreigners from engaging in the fur trade on American soil. Three years later, to enforce this act, the United States Army built Fort St. Anthony (later called Fort Snelling) at the junction of the Minnesota and Mississippi rivers. For the next 20 years the American Fur Company controlled the fur trade of the region.

Henry Schoolcraft led an expedition into the area in 1832. Schoolcraft, with Dr. Douglass Houghton and

Continued on page 291

Minnesota Fact Summary

MINNESOTA (Minn.): Named from Minnesota River, called by Dakota Indians "Minisota" (*minne*, "water"; *sotah*, "sky-tinted" or "clouded").

Nickname: "Gopher State," from the striped gopher, common on Minnesota prairies. Also, "North Star State," referring to the motto.

Seal: A white man plows, his gun leaning against a nearby stump. In background an Indian on horseback.

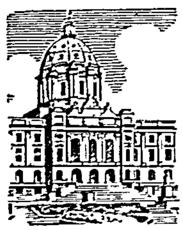
Motto: L'Étoile du Nord (The Star of the North).

Flag: For description and illustration, *see* Flags.

Flower: Pink and white moccasin flower, or lady's-slipper. **Bird (unofficial):** Goldfinch. **Tree:** Norway (red) pine.

Song (unofficial): 'Hail! Minnesota'—words, T. E. Rickard and Arthur Upson; music, T. E. Rickard.

THE GOVERNMENT



Capital: St. Paul (since 1858).

Representation in Congress: Senate, 2; House of Representatives, 9. Electoral votes, 11.

State Legislature: Senators, 67; term, 4 years. Representatives, 131; term, 2 years. Convenes Tuesday after the first Monday in January in the odd-numbered years. Session limit, 90 days.

Constitution: Adopted 1858. Proposed amendment must be (a) passed by majority vote of both legislative houses and (b) ratified by majority vote at a popular election.

Governor: Term, 2 years. May succeed himself.

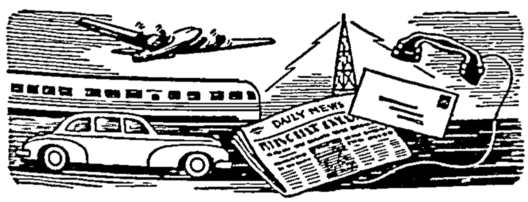
Other Executive Officers: Lieutenant governor, secretary of state, attorney general, treasurer, auditor, all elected; terms, 2 years, except auditor's, 4 years. Governor appoints a commissioner of administration, who serves as business manager; term, 2 years.

Judiciary: Supreme court—7 justices, elected at large; term, 6 years. District courts—19 districts; 51 judges elected; term, 6 years. Probate courts—1 in each county; judge elected; term, 4 years.

County: 87 counties, each governed by a county board, usually of 5 members. Boards and county officers elected; term, 4 years.

Municipal: Mayor and council plan most common; some cities have commissions and city managers.

Voting Qualifications: Age, 21; residence in state, 6 months; in district, 30 days.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 8,300 miles. First railroad, St. Paul to St. Anthony (now part of Minneapolis), 1862. Rural roads, 108,500 miles. Airports, 117.

Communication: Periodicals, 152. Newspapers, 443. First newspaper, the *Minnesota Pioneer*, St. Paul, 1849. Radio stations (AM and FM), 55; first station, WLB, Minneapolis, licensed Jan. 13, 1922. Television stations, 5; first station, KSTP-TV, St. Paul, began operation April 23, 1948. Telephones, 1,009,400. Post offices, 1,030.

THE PEOPLE AND THEIR LAND

Population (1950 census): 2,982,483 (rank among 48 states—18th); urban, 54.5%; rural, 45.5%. Density: 37.3 persons per square mile (rank—30th state).

Extent: Area, 84,068 square miles, including 4,059 square miles of water surface (11th state in size; same rank if Great Lakes area of 2,212 square miles is added).

Elevation: Highest, in Misquah Hills near Grand Marais, 2,230 feet; lowest, Lake Superior, 602 feet.

Temperature (° F.): Average—annual, 41°; winter, 12°; spring, 41°; summer, 67°; fall, 45°. Lowest, −59° (Pokegama Falls, Itasca County, Feb. 16, 1903, and other locations, earlier dates); highest, 114° (Moorhead, July 6, 1936, other locations and earlier dates).

Precipitation: Average (inches)—annual, 25; winter, 2; spring, 6; summer, 11; fall, 6. Varies from about 20 in northwest to about 32 in southeast.

Natural Features: Gently rolling surface broken by Mesabi and Vermilion ranges and Misquah Hills in the northeast, and by "10,000 lakes"—Mille Lacs, Leech Lake, Red Lake, Vermilion Lake, Winnibigoshish Lake, etc. In the southwest are the Côteau des Prairies. Principal rivers: Minnesota, Mississippi, Rainy, Red River of the North, St. Croix, and St. Louis.

Land Use: Cropland, 41%; nonforested pasture, 8%; forest, 37%; other (roads, parks, game refuges, wasteland, cities, etc.), 14%.

Natural Resources: *Agricultural*—fertile soil; adequate precipitation. *Industrial*—iron ore, sand and gravel, forests, stone. *Commercial*—position on Lake Superior and Mississippi River; picturesque vacation land.

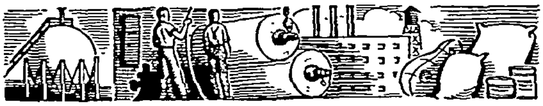
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Agriculture, forestry, and fishery	260,831	22.7
Wholesale and retail trade	228,208	19.9
Manufacturing	186,905	16.3
Professional services (medical, legal, educational, etc.)	107,156	9.4
Transportation, communication, and other public utilities	95,253	8.3
Construction	63,233	5.5
Personal services (hotel, domestic, laundering, etc.)	51,322	4.5
Government	39,689	3.5
Finance, insurance, and real estate	37,326	3.3
Business and repair services	32,695	2.9
Mining	15,803	1.4
Amusement, recreation, and related services	9,955	0.9
Workers not accounted for	15,496	1.4
Total employed	1,143,872	100.0

Minnesota Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—16th)
Value added by manufacture* (1952), $1,440,189,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
FOOD AND KINDRED PRODUCTS.... Meat packing; flour and meal; malt liquors; bakery products; prepared animal feeds; butter	$279,258,000	13
MACHINERY (EXCEPT ELECTRICAL) Tractors and farm machinery; refrigeration machinery; construction and mining machinery	128,933,000	14
PRINTING AND PUBLISHING....... Newspapers; commercial printing; lithographing	105,343,000	10
MISCELLANEOUS MANUFACTURES.. Plastics products; toys; jewelry	69,972,000	9
ELECTRICAL MACHINERY......... Controls; telephones; telegraph	68,469,000	13

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—5th)
Total cash income (1952), $1,283,901,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Corn...........	219,083,000 bu.	1	3
Hogs...........	1,430,561,000 lbs.	2	4
Milk...........	3,981,000,000 qts.	3	2
Cattle..........	886,748,000 lbs.	4	6
Oats...........	174,751,000 bu.	5	2
Eggs...........	274,000,000 doz.	6	2
Hay	6,277,000 tons	7	2
Flaxseed........	13,929,000 bu.	8	1
Wheat.........	22,004,000 bu.	9	17

*Rank in dollar value †Rank in units produced

C. Fish (Rank among states—24th)
(Lake Superior and international lakes, 1950), 4,686,000 lbs.—value, $379,000; (Mississippi River and tributaries, 1950), 13,010,000 lbs.—value, $1,372,000

D. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $433,098,000
Rank among states—9th

Minerals (1951)	Amount Produced	Value
Iron ore.............	78,165,000 tons	$411,469,000
Sand and gravel......	17,229,000 tons	6,009,000
Stone...............	1,906,000 tons	5,613,000
Manganiferous ore*...	1,132,000 tons	....

*Manganiferous ore ranks 4th in value; exact figures not available.

E. Trade

Trade (1948)	Sales	Rank among States
Wholesale........	$5,077,235,000	10
Retail..........	2,906,062,000	13
Service..........	216,018,000	14

EDUCATION

Public Schools: Elementary, 4,376; secondary, 653. Compulsory school age 7 through 15. State Board of Education composed of 7 members appointed by governor for 7-year terms. Commissioner of education appointed by state board for 6-year term. County school boards composed of 5 members elected for 4-year terms. County supts. elected for 4-year terms. City school boards elected. City supts. appointed by city boards.

Private and Parochial Schools: 398.

Colleges and Universities (accredited): Colleges, 22; junior colleges, 11. State-supported schools include the University of Minnesota, Minneapolis, with a branch at Duluth; 5 teachers colleges—Bemidji, Mankato, Moorhead, St. Cloud, and Winona; 9 junior colleges located throughout state.

State Schools for the Handicapped: Owatonna State School, Owatonna; Braille and Sight Saving School, School for the Deaf, Minnesota School and Colony, all at Faribault; Cambridge State School and Hospital, Cambridge; Gillette School for Crippled Children, St. Paul.

Libraries: City and town public libraries, 158; independent county libraries, 8; 16 counties contract for service with city libraries. Library Div., Dept. of Education, responsible for aid in developing public and school library service. Noted special libraries: James J. Hill Reference Library, St. Paul; Medical Library of Mayo Foundation, Rochester.

Outstanding Museums: Minneapolis Institute of Arts, Museum of Natural History of the University of Minnesota, Walker Art Center, all in Minneapolis; Minnesota Historical Society Museum; Science Museum, St. Paul Institute, both in St. Paul.

CORRECTIONAL AND PENAL INSTITUTIONS

State Training School for Boys, Red Wing; Home School for Girls, Sauk Centre; Reformatory for Women, Shakopee; Reformatory for Men, St. Cloud; State Prison, Stillwater.

STATE PARKS AND STATE MEMORIAL PARKS*†

Baptism River—in rugged area of Saw Tooth Mountains; river flows over highest waterfall in state (17).

Beaver Creek Valley—near Caledonia; "Old Schech Mill," built in 1896, still in operation (46).

Buffalo River—east of Moorhead; commemorates Campbell Beach of prehistoric Lake Agassiz (26).

Charles A. Lindbergh Memorial—near Little Falls; in honor of flier's father; boyhood home of flier (32).

Fort Ridgely Memorial—south of Fairfax; site of old fort (1853); commissary restored as museum (38).

Interstate—at Taylors Falls; many potholes (33).

Itasca—near Bemidji; virgin pine and 157 lakes including Lake Itasca, one of sources of Mississippi River (21).

Minneopa—near Mankato; Minneopa Creek flows over two waterfalls into a deep gorge (42).

Nerstrand Woods—virgin forests; plant life (41).

Scenic—southeast of Bigfork; Minnesota's most primitive park; stands of virgin pine; west of state forest (15).

Sibley—near New London on shores of Lake Andrew; virgin hardwoods and red cedar grow profusely (34).

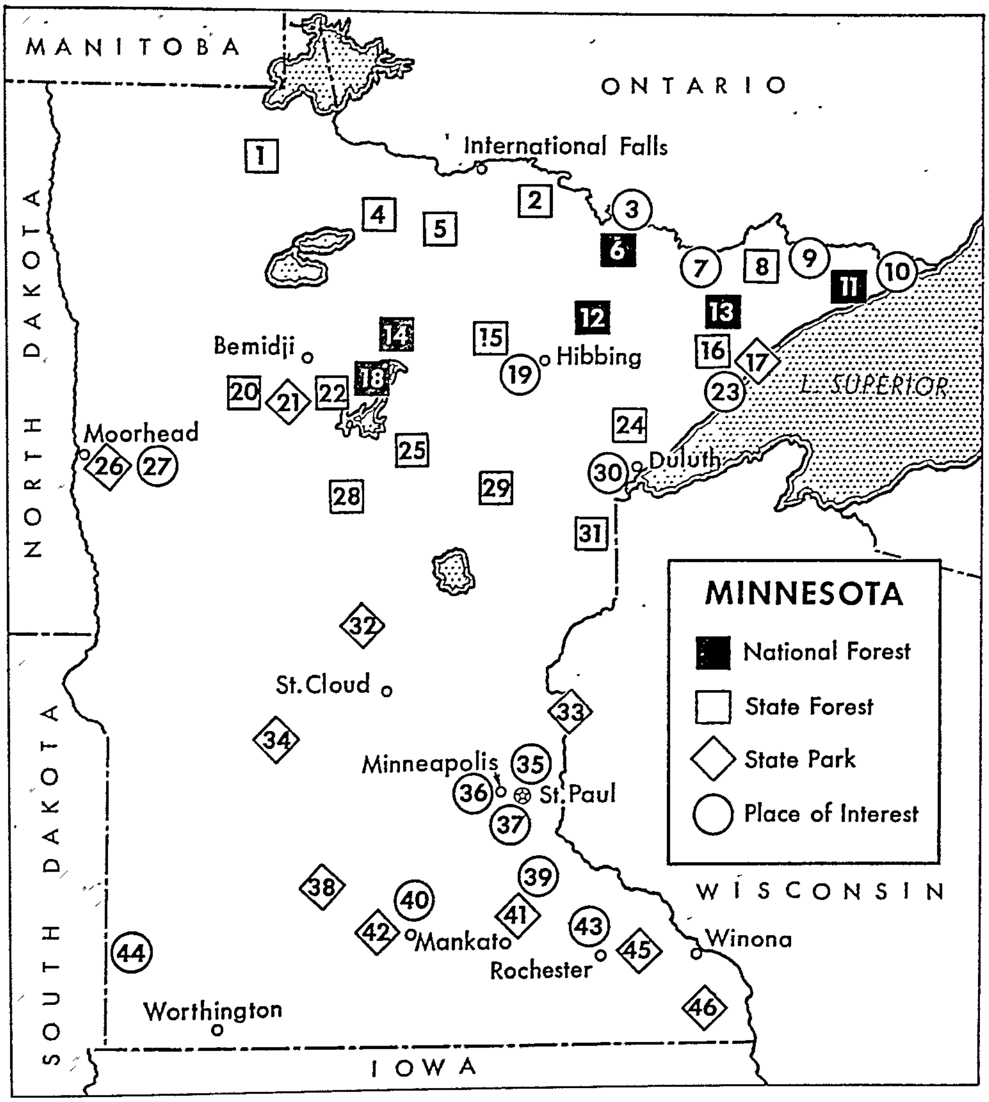
Whitewater—near Winona; Whitewater River and other creeks flow through area; limestone formations (45).

*Numbers in parentheses are keyed to map.
†There are 37 state parks and memorial parks; 12 are given.

Minnesota Fact Summary

STATE FORESTS*†

Beltrami Island (Lake of the Woods, Roseau, Beltrami Cos.)—480,000 acres (1).
Cloquet Valley (St. Louis Co.)—307,011 acres (24).
Finland (Lake, Cook Cos.)—149,240 acres (16).
Foot Hills (Cass, Hubbard, Wadena Cos.)—202,900 acres (28).
George Washington (Itasca, St. Louis Cos.)—371,000 acres (15).
Kabetogama (St. Louis Co.)—789,800 acres (2).
Koochiching (Koochiching Co.) — 208,855 acres (5).
Land O'Lakes (Cass Co.)—139,521 acres (25).
Minnesota (St. Louis, Lake, Cook Cos.) — 211,767 acres (8).
Nemadji (Carlton, Pine Cos.)—150,537 acres (31).
Paul Bunyan (Hubbard Co.) — 152,920 acres (22).
Pine Island (Koochiching, Beltrami Cos.) — 587,829 acres (4).
Savanna (Aitkin Co.)—213,860 acres (29).
White Earth (Clearwater, Mahnomen, Becker Cos.) 203,285 acres (20).



PLACES OF INTEREST*

Anchor Stones—near Hawley, granite boulders to which early Norsemen are believed to have tied boats (27).
Duluth—many points of interest; Superior Ship Canal, Skyline Parkway, iron-ore docks (*see* Duluth) (30).
Fort Snelling Round Tower—built in 1820; used as a lookout in pioneer days; now a museum (37).
Grand Portage—Indian village; North West Company's fur-trading post; old 9-mile trail between Lake Superior and Pigeon River became a national historic site in 1951; fishing center (10).
Hibbing—world's largest open-pit iron mine (19).
Mendota—Henry Hastings Sibley House built in 1835; Jean Baptiste Faribault House built 2 years later (37).
Minneapolis—many places of interest; Minnehaha Park; Walker Art Center (*see* Minneapolis) (36).
Northfield—Carlton and St. Olaf colleges; 1,500 Indian mounds within a radius of ten miles (39).
Pipestone National Monument—quarries of red stone from which ancient Indians made their peace pipes (44).
Roadless Area—the only "roads" are canoe routes on pine-bordered lakes and streams (3, 7, 9).
Rochester—home of Mayo Clinic; Mayo Foundation Museum of Hygiene and Medicine open to public (43).
St. Paul—State Capitol, Minnesota Historical Society, Cathedral of St. Paul, St. Paul Institute, Robert Street Bridge (*see* St. Paul) (35).
Split Rock Lighthouse—on shores of Lake Superior near Beaver Bay; warns ships of dangerous reefs (23).
Traverse Des Sioux—historic ford across the Minnesota River; near St. Peter (40).

NATIONAL FORESTS*

Chippewa—1,313,656 acres; headquarters, Cass Lake (14, 18).
Superior—2,873,292 acres; headquarters, Duluth (6, 11, 12, 13).

LARGEST CITIES (1950 census)

Minneapolis (521,718): large flour-milling center on Mississippi River; grain market; manufactures linseed-oil products, machinery; University of Minnesota.
St. Paul (311,349): state capital; distribution point on Mississippi River for rich agricultural area; meat packing; machine shops; printing and publishing.
Duluth (104,511): large harbor at head of Lake Superior; ore and coal docks; grain elevators; industrial center.
Rochester (29,885): industrial and commercial city in farming area; Mayo Clinic, famous medical center.
St. Cloud (28,410): granite industry; railroad shops.

*Numbers in parentheses are keyed to map.
†There are 32 state forests; the 14 largest are listed.

Minnesota Fact Summary

THE PEOPLE BUILD THEIR STATE

1362—Party of Norsemen penetrate into Minnesota, according to the "Kensington Stone" found in 1898; authenticity of stone disputed.

1660—Pierre Esprit, Sieur de Radisson and Medard Chouart, Sieur des Groseilliers, French fur traders, explore western shore of Lake Superior. They begin travel by canoe up the St. Lawrence R. and across the Great Lakes, later a famous fur trade route.

1671—Minnesota included in "country of the West" claimed for France by Simon Daumont, Sieur de St. Lusson.

1678—Daniel Greysolon, Sieur du Lhut (or Duluth), begins 11 years' exploration of Minnesota country.

1680—Father Louis Hennepin discovers Falls of St. Anthony; meets Du Lhut near mouth of St. Croix R.

1695—Pierre LeSueur builds trading post on Prairie Is.

1727—Father Michel Guignas founds first mission in Minnesota, St. Michel Archange, on Lake Pepin.

1731—Pierre Gaultier de Varennes, Sieur de la Vérendrye, explores canoe route from Pigeon R. to Rainy Lake.

1754—French and Indian War begins; many French leave.

1762—France cedes to Spain its lands west of Mississippi; Spain secretly returns land to France in 1800.

1763—England wins eastern Minnesota from France.

1766—Jonathan Carver of Connecticut explores northern Minnesota seeking northern route to the Pacific.

1783—By Treaty of Paris, eastern Minnesota ceded by Great Britain to United States. North West Company begins 32 years of fur trading in Minnesota country, Grand Portage its largest post.

1803—Western Minnesota included in area bought by U. S. from France in Louisiana Purchase.

1805—Lieut. Z. Pike chooses site for Fort St. Anthony.

1812—Minnesota Indian tribes side with British in war with U. S.; attack settlers and outposts.

1814—British claims in Minnesota area settled by Treaty of Ghent; British troops evacuate Prairie du Chien.

1817—John Jacob Astor's American Fur Company takes over fur trade in Minnesota area.

1819—Work begins on Fort St. Anthony (Fort Snelling).

1823—First flour milled at Falls of St. Anthony. First steamship, the *Virginia*, reaches Fort Snelling from lower Mississippi River, May 10.

1832—Henry Schoolcraft locates source of Mississippi R.

1834—Pond brothers begin their mission work with Sioux Indians; later develop Sioux written language.

1837—Treaties with Sioux and Chippewa Indians open land between Mississippi and St. Croix rivers to whites.

1839—First commercial sawmill built at Marine on St. Croix River.

1840—Settlers found St. Paul, May 6; name settlement after church erected on site, 1841.

1847—First settlement made on site of Minneapolis. First public school in area opened at St. Paul.

1848—Opening of land office at St. Croix Falls brings large group of settlers. Convention at Stillwater, August 26, plans Minnesota Territory.

1849—Minnesota Territory created, March 3; north, south, and east boundaries are same as present state borders; western boundary is Missouri and White Earth rivers. First territorial legislature meets at St. Paul under Gov. Alexander Ramsey; legislature establishes system of free education.

1851—Treaty with Sioux Indians is first of several to open land west of Mississippi R. to white settlements. University of Minnesota chartered at Minneapolis; first collegiate instruction, 1869.

1853—Territorial Capitol completed at St. Paul. Proclamation of Sioux treaties brings flood of settlers.

1854—Chippewa Indians cede lands in north-central Minnesota and north of Lake Superior. Commercial flour milling begins at Falls of St. Anthony.

1855—Opening of Sault Ste. Marie Canal permits traffic from Minnesota through Great Lakes to east coast.

1857—Constitution framed for proposed statehood.

1858—Minnesota admitted to the Union, May 11; capital, St. Paul; governor, Henry H. Sibley. Western boundary fixed along present line.

1860—First state teachers college west of Mississippi River opened at Winona. Telegraph link between Twin Cities and the East opened.

1862—Homestead Act encourages new immigration. State militia having joined Union forces, Sioux massacre many settlers; uprising lasts until 1865.

1863—Minnesota's First Regiment plays important role in Union victory at Gettysburg, July 1–3.

1867—Minnesota Central Railway provides rail link with Chicago. Postwar prosperity brings new flood of immigrants, largely Scandinavian and German. Minnesotan Oliver Kelley founds in St. Paul the Patrons of Husbandry (the Grange). Grangers sponsor co-operatives; reach apex of political power, 1874; begin decline, 1875.

1883—Northern Pacific Railway completes link between Minnesota and Pacific coast.

1884—First load of iron ore shipped from Minnesota by way of Lake Superior to the East.

1889—Dr. William Mayo opens hospital, which later becomes Mayo Clinic, in Rochester. First co-operative creamery organized at Biscay.

1890—Merritt brothers announce discovery of Mesabi iron ore. Lumbermen enter northeastern Minnesota; shortly afterward Virginia, Minn., claims to have largest white-pine sawmill in world.

1891—Theophilus L. Haecker joins staff of University of Minnesota, taking leadership in building co-operative creameries, which boom dairy industry.

1892—First iron ore shipped from Mesabi Range.

1901—Minnesota's exhibits at Pan American Exposition win state title of "Bread and Butter State."

1902—Charles A. Lindbergh, born at Detroit, Mich.; spends his youth at Little Falls, Minn.

1911—New Cuyana Range begins production of iron.

1915—Mayo Foundation established at University of Minnesota.

1918—Farmer-Labor party becomes political force.

1919—Chippewa Agency set up to administer reservations. Legislation protects farmers' co-operatives.

1921—First oil co-operative in nation organized at Cottonwood.

1925—State government is reorganized.

1930—Sinclair Lewis, born at Sauk Center, wins Nobel prize for literature.

1931—Fossilized remains, "Minnesota Man," one of oldest in North America, found near Pelican Rapids.

1942—University of Minnesota's Experiment Station processes abundant taconite, a low-grade iron ore.

1949—State's National Guard permits Negro enlistment.

1954—First full-scale commercial taconite plant under construction at Beaver Bay; advance section at the mine near Babbitt in operation since 1953.

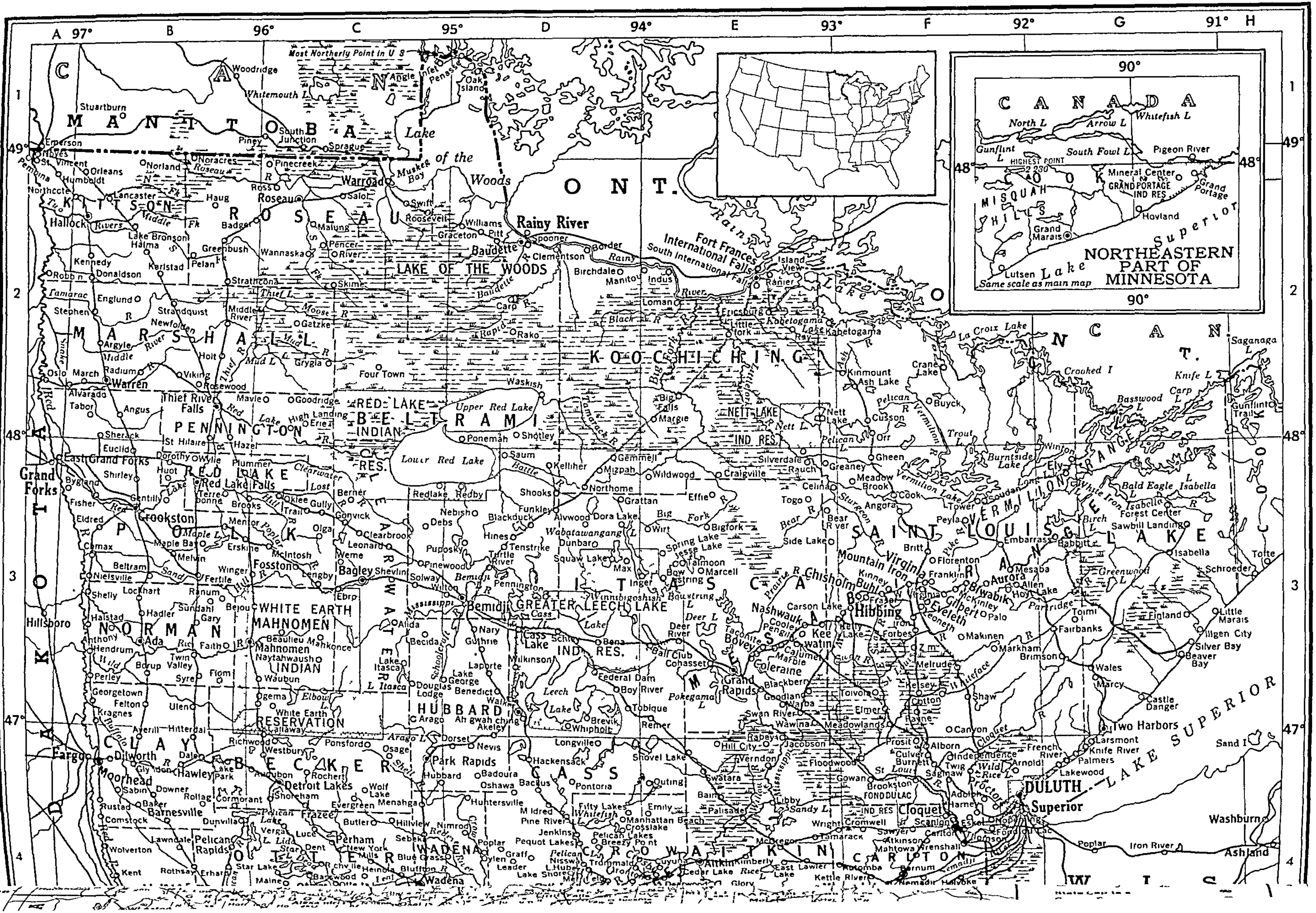
COUNTIES

Aitkin	14,327	E 4
Anoka	35,579	E 5
Becker	24,836	C 4
Beltrami	24,962	C 2
Benton	15,911	D 5
Big Stone	9,607	B 5
Blue Earth	38,327	D 6
Brown	25,895	D 6
Carlton	24,584	F 4
Carver	18,155	E 6
Cass	19,468	D 4
Chippewa	16,739	C 5
Chisago	12,669	F 5
Clay	30,363	B 4
Clearwater	10,204	C 3
Cook	2,900	H 3
Cottonwood	15,763	C 6
Crow Wing	30,875	D 4
Dakota	49,019	E 6
Dodge	12,624	F 7
Douglas	21,304	C 5
Faribault	23,879	D 7
Fillmore	24,465	F 7
Freeborn	34,517	E 7
Goodhue	32,118	F 6
Grant	9,542	B 5
Hennepin	676,579	E 5
Houston	14,435	G 7
Hubbard	11,085	D 3
Isanti	12,123	E 5
Itasca	33,321	E 3
Jackson	16,306	C 7
Kanabec	9,192	E 5
Kandiyohi	28,644	C 5
Kittson	9,649	B 2
Koochiching	16,910	E 2
Lac qui Parle	14,545	B 6
Lake	7,781	G 3
Lake of the Woods	4,955	D 2
Le Sueur	19,088	E 6
Lincoln	10,150	B 6
Lyon	22,253	C 6
Mahnomen	7,059	C 3
Marshall	16,125	B 2
Martin	25,655	D 7
McLeod	22,198	D 6
Meeker	18,966	D 5
Mille Lacs	15,165	E 5
Morrison	25,832	D 4
Mower	42,277	F 7
Murray	14,801	C 6
Nicollet	20,929	D 6
Nobles	22,435	C 7
Norman	12,909	B 3
Olmsted	48,228	F 7
Otter Tail	51,320	C 4
Pennington	12,965	B 2
Pine	18,223	F 4
Pipestone	14,003	B 6
Polk	35,900	B 3
Pope	12,862	C 5
Ramsey	355,332	E 5
Red Lake	6,806	B 3
Redwood	22,127	C 6
Renville	23,954	C 6
Rice	36,235	E 6
Rock	11,278	B 7
Roseau	14,505	C 2
St. Louis	206,062	F 3
Scott	16,486	E 6
Sherburne	10,661	E 5
Sibley	15,816	D 6
Stearns	70,681	D 5
Steele	21,155	E 7
Stevens	11,106	B 5
Swift	15,837	C 5
Todd	25,420	D 4
Traverse	8,053	B 5
Wabasha	16,878	F 6
Wadena	12,806	D 4
Waseca	14,957	E 6
Washington	34,544	F 5
Watonwan	13,881	D 7
Wilkin	10,567	B 4
Winona	39,841	G 6
Wright	27,716	D 5
Yellow Medicine	16,279	B 6

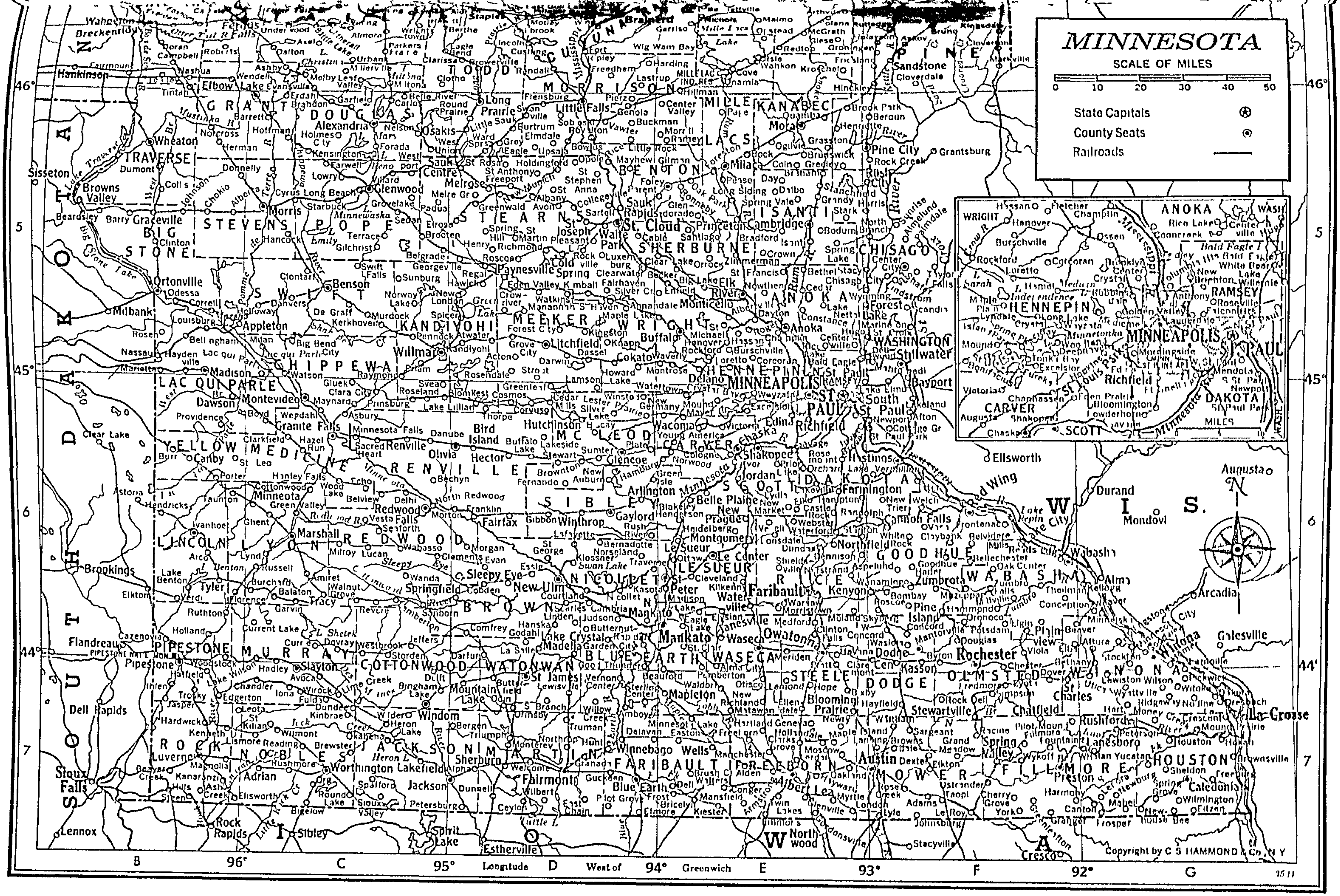
CITIES AND TOWNS

Acton	2	D 5
Ada	2,121	B 3
Adams	663	F 7
Adolph	53	F 4
Adrian	1,115	C 7
Afton	142	F 6
Ah-gwah-ching	360	D 3
Aitkin	2,079	E 4
Akeley	525	D 3
Albany	1,196	D 5
Albert Lea	13,545	E 7
Alberta	139	B 5
Albertville	238	E 5
Alborn	30	F 4
Alden	668	E 7
Aldrich	131	C 4
Alexandria	6,319	C 5
Alida	6	C 3
Allen	21	F 3
Alma City	150	E 6
Almelund	175	F 5
Almora	82	C 4
Alpha	230	D 7
Altura	269	G 6
Alvarado	317	B 2
Alvwood	25	D 3
Amboy	585	D 7
Amiret	90	C 6
Amor	20	C 4
Angle Inlet	50	C 1
Angora	65	F 3
Angus	100	B 2
Annandale	899	D 5
Anoka	7,396	E 5
Anthony	2	B 3
Appleton	2,256	C 5
Arago	11	C 3
Arco	178	B 6
Argyle	846	B 2
Arlington	1,313	D 6
Armstrong	25	E 7
Arnold	670	F 4
Arthyde	10	E 4
Asbury	2	C 6
Ash Creek	70	B 7
Ash Lake	15	F 2
Ashby	443	C 4
Askov	387	F 4
Aspelund	20	F 6
Atkinson	20	F 4
Atwater	880	D 5
Audubon	275	C 4
Augusta	20	F 6
Aurora	1,371	F 3
Austin	23,100	F 7
Automba	25	F 4
Averill	46	B 4
Avoca	281	C 7
Avon	386	D 5
Axel	2	C 4
Babbitt	35	G 3
Backus	367	D 4
Badger	448	B 2
Badoura	250	D 4
Bagley	1,554	C 3
Bain	15	E 4
Baker	70	B 4
Balaton	723	C 6
Bald Eagle	1,650	E 5
Ball Club	100	E 3
Balmoral	10	C 4
Barnesville	1,593	B 4
Barnum	344	F 4
Barrett	402	B 5
Barry	74	B 5
Basswood	22	C 4
Battle Lake	714	C 4
Baudette	929	D 2
Baxter	507	D 4
Bay Lake	50	E 4
Bayport	2,502	F 5
Bear River	75	E 3
Beardsley	435	B 5
Beauford	250	D 7
Beaulieu	100	C 3
Beaver	13	F 6
Beaver Bay	100	G 3
Beaver Creek	245	B 7
Bechyn	32	C 6
Becida	8	C 3
Becker	264	E 5
Bee	11	G 7
Bejou	173	B 3
Belgrade	659	C 5
Belle Plaine	1,708	E 6
Belle River		C 5
Bellechester	225	F 6
Bellingham	388	B 5
Beltrami	199	B 3
Belvidere Mills	10	F 6
Belview	381	C 6
Bemidji	10,001	D 3
Bena	331	D 3
Benedict	10	D 3
Bennettville		E 4
Benson	3,398	C 5
Bergen	40	D 7
Bernadotte	19	D 6
Berner	20	C 3
Beroun	120	F 5
Bertha	577	C 4
Bethany	35	F 6
Bethel	250	E 5
Big Bend City	650	C 5
Big Falls	441	E 2
Big Lake	480	E 5
Bigelow	238	C 7
Bigfork	463	E 3
Bingham Lake	229	C 7
Birchdale	20	D 2
Birchwood	312	*F 5
Bird Island	1,333	D 6
Biscay	90	D 6
Biwabik	1,245	F 3
Bixby	75	E 7
Blackberry	20	E 3
Blackduck	732	D 3
Blakeley	98	E 6
Blomkest	150	D 6
Bloomington	500	G 6
Blooming Prairie	1,442	E 7
Blue Earth	3,843	D 7
Blue Grass	50	C 4
Bluffton	239	C 4
Bock	96	E 5
Bodum	4	E 5
Bombay	28	F 6
Border	5	D 2
Borup	200	B 3
Bovey	1,320	E 3
Bowlus	233	D 5
Bowstring	300	E 3
Boy River	82	D 3
Boyd	496	C 6
Bradford		E 5
Braham	697	E 5
Brainerd	12,637	D 4
Brandon	319	C 5
Breckenridge	3,623	B 4
Breezy Point		D 4
Brevik	50	D 3
Brewster	478	C 7
Bricelyn	639	E 7
Brimson	40	F 3
Britt	50	F 3
Brook Park	148	F 5
Brooklyn Ctr.	4,284	G 5
Brooks	184	B 3
Brookston	180	F 4
Brooten	669	C 5
Browerville	735	D 4
Browns Valley	1,117	B 5
Brownsdale	493	F 7
Brownsville	330	G 7
Brownton	696	D 6
Bruno	193	F 4
Brunswick	100	E 5
Brush Creek	18	E 7
Brushvale	16	B 4
Buckman	173	D 5
Buffalo	1,914	E 5
Buffalo Lake	724	D 6
Buhl	1,462	F 3
Burchard	25	C 6
Burnett	68	F 4
Burr	63	B 6
Burschville	16	E 5
Burtrum	194	D 5
Butler	72	C 4
Butterfield	529	D 7
Butternut	22	D 6
Buyck	98	F 2
Bygland		B 3
Byron	385	F 6
Cable	10	D 5
Caledonia	2,243	G 7
Callaway	193	C 3
Calumet	854	E 3
Cambria	63	D 6
Cambridge	1,790	E 5
Campbell	391	B 4
Canby	2,173	B 6
Cannon Falls	1,831	F 6
Canton	459	F 7
Canyon	115	F 3
Carlisle	24	B 4
Carlos	233	C 5
Carlton	650	F 4
Carp	15	D 2
Carson Lake	700	E 3
Carver	548	E 6
Cass Lake	1,936	D 3
Castle Danger	75	G 3
Castle Rock	100	E 6
Cazenovia	26	B 6
Cedar	75	E 5
Cedar Lake	3	E 4
Cedar Mills	99	D 6
Celina		E 3
Center City	311	F 5
Center Valley		E 5
Centerville	209	E 5
Ceylon	618	D 7
Champlin	828	E 5
Chandler	331	C 7
Chanhassen	182	F 6
Chaska	2,008	E 6
Chatfield	1,605	F 7
Cherry Grove	100	F 7
Chester	100	F 6
Chisago City	703	E 5
Chisholm	6,861	E 3
Chokio	541	B 5
Clara City	1,106	C 6
Claremont	426	F 6
Clarissa	650	C 4
Clarkfield	1,012	C 6
Clarks Grove	254	E 7
Claybank	6	F 6
Clear Lake	297	E 5
Clearbrook	539	C 3
Clearwater	224	D 5
Clements	239	D 6
Clementson	11	D 2
Cleveland	325	E 6
Climax	271	B 3
Clinton	718	B 5
Clinton Falls		E 6
Clitherall	175	C 4
Clontarf	206	C 5
Cloquet	7,685	F 4
Clotho	30	C 4
Cloverdale	25	F 4
Cloverton	26	F 4
Cobden	118	D 6
Cohassett	484	E 3
Coin	3	E 5
Cokato	1,403	D 5
Cold Spring	1,488	D 5
Coleraine	1,321	E 3
Collegeville	480	D 5
Collis	50	B 5
Cologne	462	E 6
Columbia Heights	8,175	G 5
Comfrey	642	D 6
Comstock	139	B 4
Conception	300	F 6
Concord	85	F 6
Conger	161	E 7
Constance	25	E 5
Cook	482	F 3
Cooley	113	E 3
Coon Creek	275	G 5
Corcoran	75	E 5
Cormorant	34	B 4
Correll	130	B 5
Corvuso	22	D 6
Cosmos	382	D 6
Cottage Grove	143	F 6
Cotton	20	F 3
Cottonwood	709	C 6
Courtland	251	D 6
Cove	35	E 4
Craigville	50	E 3
Crane Lake	93	F 2
Cromwell	197	F 4
Crookston	7,352	B 3
Crosby	2,777	D 4
Crosslake	50	E 4
Crow Wing	18	D 4
Crown	30	E 5
Crowriver	10	D 5
Crystal	5,713	G 5
Crystal Bay	250	E 6
Culver	45	F 4
Current Lake	20	C 6
Currie	531	C 6
Cushing	71	D 4
Cusson	25	F 2
Cuyuna	112	E 4
Cyrus	363	C 5
Dakota	300	G 7
Dalbo	58	E 5
Dale	54	B 4
Dalton	279	C 4
Danube	437	C 6
Danvers	162	C 5
Darfur	150	D 6
Darwin	273	D 5
Dassel	962	D 5
Dawson	1,834	B 6
Day	45	E 5
Dayton	363	E 5
De Graff	270	C 5
Debs	25	C 3
Deephaven	1,823	F 5
Deer Creek	349	C 4
Deer River	1,033	E 3
Deerwood	572	E 4
Delano	1,386	E 5
Delavan	302	D 7
Delft	125	C 7
Delhi	152	C 6
Dell	15	E 7
Dellwood	245	F 5
Denham	96	F 4
Dennison	163	E 6
Dent	187	C 4
Detroit Lakes	5,787	C 4
Dexter	316	F 7
Dilworth	1,429	B 4
Dodge Center	1,151	F 6
Donaldson	128	B 2
Donnelly	396	B 5
Dora Lake	140	D 3
Doran	126	B 4
Dorothy	46	B 3
Dorset	55	D 4
Douglas	102	F 6
Douglas Lodge	2	C 3
Dover	263	F 7
Dovray	127	C 6
Downer	135	B 4
Dresbach	200	G 7
Duluth	104,511	F 4
Dumont	223	B 5
Dunbar	76	D 3
Dundas	469	E 6
Dundee	179	C 7
Dunnell	242	D 7
Dunvilla	4	B 4
Duquette	65	F 4
Eagle Bend	691	C 4
Eagle Lake	310	E 6
East Chain	80	D 7
East Grand Forks	5,049	B 3
East Gull Lake	238	D 4
East Lake	65	E 4
Easton	379	E 7
Ebro	70	C 3
Echo	490	C 6
Eden Prairie	100	G 6
Eden Valley	792	D 5
Edgerton	961	B 7
Edina	9,744	E 6
Effie	202	E 3
Eitzen	151	G 7
Elba	147	F 6
Elbow Lake	1,398	B 4
Eldred	44	B 3
Elgin	438	F 6
Elizabeth	168	B 4
Elk River	1,399	E 5
Elko	111	E 6
Elkton	141	F 7
Ellendale	476	E 7
Ellsworth	630	C 7
Elmdale	119	D 5
Elmer	216	F 3
Elmore	1,074	D 7
Elrosa	173	C 5
Ely	5,474	G 3
Elysian	402	E 6
Embarrass	450	F 3
Emily	200	E 4
Emmons	356	E 7
Enfield	26	E 5
Englund	6	B 2
Erdahl	120	C 5
Erhard	145	B 4
Ericsburg	210	E 2
Erie	20	C 2
Erskine	608	B 3
Esko	300	F 4

* No room on map for name.



NORTHEASTERN PART OF MINNESOTA
Same scale as main map
CANADA
ONT.
MANITOBA
Lake of the Woods
Most Northerly Point in U S
LAKE SUPERIOR
DULUTH
Superior
Rainy River
Fort Frances
International Falls
Grand Forks
Fargo
Moorhead
Bemidji
Hibbing
Virginia
Grand Rapids
Crookston
Thief River Falls
Cloquet
Two Harbors
KOOCHICHING
BELTRAMI
SAINT LOUIS
LAKE
COOK
ITASCA
CASS
HUBBARD
BECKER
CLAY
NORMAN
POLK
RED LAKE
PENNINGTON
MARSHALL
KITTSON
ROSEAU
LAKE OF THE WOODS
CLEARWATER
MAHNOMEN
WADENA
CARLTON
AITKIN
CROW WING
OTTER TAIL
Upper Red Lake
Lower Red Lake
RED LAKE INDIAN RES.
NETT LAKE IND RES
GREATER LEECH LAKE
WHITE EARTH INDIAN RESERVATION
MISQUAH HILLS
GRAND PORTAGE IND RES


MINNESOTA
SCALE OF MILES
0 10 20 30 40 50
State Capitals
County Seats
Railroads
ANOKA
HENNEPIN
RAMSEY
MINNEAPOLIS
ST. PAUL
CARVER
SCOTT
DAKOTA
WRIGHT
MILES
Longitude West of Greenwich
96° 95° 94° 93° 92°
46° 45° 44°
B C D E F G
5 6 7
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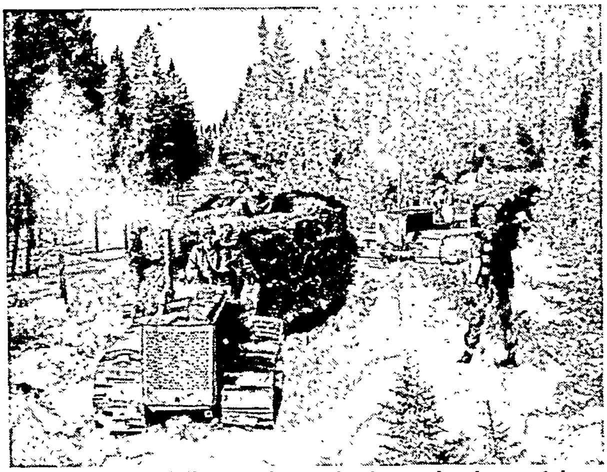
TRAVERSE
GRANT
DOUGLAS
TODD
MORRISON
MILLE LACS
KANABEC
PINE
STEVENS
POPE
STEARNS
BENTON
SHERBURNE
ISANTI
CHISAGO
BIG STONE
SWIFT
KANDIYOHI
MEEKER
WRIGHT
ANOKA
WASHINGTON
LAC QUI PARLE
CHIPPEWA
HENNEPIN
YELLOW MEDICINE
RENVILLE
MC LEOD
CARVER
SCOTT
DAKOTA
LINCOLN
LYON
REDWOOD
SIBLEY
NICOLLET
LE SUEUR
RICE
GOODHUE
WABASHA
BROWN
PIPESTONE
MURRAY
COTTONWOOD
WATONWAN
BLUE EARTH
WASECA
STEELE
DODGE
OLMSTED
WINONA
ROCK
NOBLES
JACKSON
MARTIN
FARIBAULT
FREEBORN
MOWER
FILLMORE
HOUSTON
SOUTH DAKOTA
IOWA
WIS.
St. Cloud
Minneapolis
St. Paul
Rochester
Mankato
Winona
La Crosse

Essig	88	D 6
Etter	100	F 6
Euclid	120	B 3
Eureka	50	F 5
Evan	141	D 6
Evansville	478	C 4
Eveleth	5,872	F 3
Everdell	10	B 4
Evergreen	10	C 4
Excelsior	1,763	E 6
Eyota	495	F 7
Fairbanks	12	G 3
Fairfax	1,143	D 6
Fairhaven	200	D 5
Fairmont	8,193	D 7
Faith	29	B 3
Falcon Hts.	3,884	G 5
Faribault	16,028	E 6
Farmington	1,916	E 6
Farwell	112	C 5
Federal Dam	225	D 3
Felton	258	B 3
Fergus Falls	12,917	B 4
Fernando	25	D 6
Fertile	890	B 3
Fifty Lakes	160	D 4
Fillmore		F 7
Finland	175	G 3
Finlayson	195	F 4
Fisher	302	B 3
Flensburg	281	D 5
Fletcher	70	F 5
Flom	75	B 3
Floodwood	667	E 4
Florence	137	B 6
Florenton	95	F 3
Foley	1,089	D 5
Fond du Lac	500	F 4
Forada	89	C 5
Forbes	125	F 3
Forest Center	100	G 3
Forest City	50	D 5
Forest Lake	1,766	F 5
Foreston	301	E 5
Fort Ripley	88	D 4
Fort Snelling	1,096	G 5
Fosston	1,614	C 3
Fountain	312	F 7
Four Town	6	C 2
Foxhome	217	B 4
Franklin	546	D 6
Franklin	115	F 3
Fraser	134	F 3
Frazee	1,021	C 4
Freeborn	268	E 7
Freeburg	58	G 7
Freedhem	30	D 4
Freeport	558	D 5
French River		G 4
Fridley	3,796	G 5
Friesland	25	F 4
Frontenac	151	F 6
Frost	326	D 7
Fulda	1,149	C 7
Funkley	28	D 3
Garden City	273	D 6
Garfield	244	C 5
Garrison	150	E 4
Garvin	264	C 6
Gary	278	B 3
Gatzke	36	C 2
Gaylord	1,229	D 6
Gemmell	150	D 3
Geneva	332	E 7
Genola	79	D 5
Gentilly	100	B 3
Georgetown	192	B 3
Georgeville	50	C 5
Gheen	67	F 3
Ghent	336	C 6
Gibbon	830	D 6
Giese	50	E 4
Gilbert	2,247	F 3
Gilchrist	80	C 5
Gilman	150	E 5
Glen	30	E 4
Glencoe	2,801	D 6
Glendorado	11	E 5
Glenville	672	E 7
Glenwood	2,666	C 5
Glory	2	E 4
Gluek	70	C 6
Glyndon	411	B 4
Godahl	40	D 6
Golden Valley	5,551	G 5
[illegible]	375	C 3
Good Thunder	476	D 6
Goodhue	489	F 6
Goodland	450	E 3
Goodridge	144	C 2
Goodview	777	G 6
Gordonsville	100	E 7
Gowan		F 4
Graceton	38	D 2
Graceville	962	B 5
Graff	125	D 4
Granada	403	D 7
Grand Marais	1,078	G 2
Grand Meadow	766	F 7
Grand Portage	150	G 2
Grand Rapids	6,019	E 3
Grandy	175	E 5
Granger	158	F 7
Granite Falls	2,511	C 6
Grasston	154	E 5
Grattan'	100	D 3
Greaney	100	F 3
Greeley	12	E 5
Green Isle	332	E 6
Green Valley	121	C 6
Greenbush	713	B 2
Greenleaf	28	D 6
Greenleafton	54	F 7
Greenwald	207	D 5
Grey Eagle	400	D 5
Groningen	27	F 4
Grove City	481	D 5
Grovelake	60	C 5
Grygla	216	C 2
Guckeen	116	D 7
Gully	183	C 3
Gunflint Trail		H 2
Guthrie	60	D 3
Hackensack	272	D 4
Hader	30	F 6
Hadler	10	B 3
Hadley	139	C 7
Hallock	1,552	A 2
Halma	177	B 2
Halstad	635	B 3
Hamburg	184	D 6
Hamel	200	F 5
Hammond	192	F 6
Hampton	275	E 6
Hancock	852	C 5
Hanley Falls	320	C 6
Hanover	228	E 5
Hanska	473	D 6
Harding	124	E 4
Hardwick	297	B 7
Harmony	1,022	F 7
Harney	75	F 4
Harris	569	F 5
Hart	18	G 7
Hartland	300	E 7
Hassan	50	E 5
Hastings	6,560	F 6
Hatfield	110	B 7
Haug	14	B 2
Havana	18	E 6
Hawick	63	D 5
Hawley	1,196	B 4
Haydenville	10	B 5
Hayfield	805	F 7
Hayward	241	E 7
Hazel	20	B 2
Hazel Run	129	C 6
Hector	1,196	D 6
Heidelberg	61	E 6
Heinola	9	C 4
Henderson	762	E 6
Hendricks	781	B 6
Hendrum	352	B 3
Henning	1,004	C 4
Henriette	57	E 5
Herman	752	B 5
Heron Lake	837	C 7
Hewitt	312	C 4
Hibbing	16,276	F 3
High Landing	7	C 2
Hill City	501	E 4
Hillman	85	E 4
Hills	520	B 7
Hillview	45	C 4
Hinckley	902	F 4
Hines	100	D 3
Hitterdal	262	B 4
Hoffman	575	C 5
Hokah	643	G 7
Holdingford	458	D 5
Holland	263	B 6
Hollandale	360	E 7
Holloway	264	C 5
Holmes City	116	C 5
Holt	172	B 2
Holyoke	75	F 4
Homer	200	G 6
Hope	148	E 7
Hopkins	95	G 5
Houston	973	G 7
Hovland	300	G 2
Howard Lake	931	D 5
Hoyt Lake		F 3
Hubbard	140	C 4
Hugo	440	E 5
Humboldt	143	A 2
Huntersville	25	D 4
Huntley	118	D 7
Huot	12	B 3
Hutchinson	4,690	D 6
Ihlen	135	B 7
Illgen City	7	G 3
Independence	20	F 4
Indus	55	E 2
Inger	100	D 3
International Falls	6,269	E 2
Inver Grove	667	E 6
Iona	355	C 7
Iron	128	F 3
Ironton	828	D 4
Isabella		G 3
Isanti	422	E 5
Island Park	1,357	F 5
Island View	18	E 2
Isle	674	E 4
Ivanhoe	682	B 6
Jackson	3,313	C 7
Jacobson	106	E 4
Janesville	1,287	E 6
Jasper'	840	B 7
Jeffers	516	C 6
Jenkins	170	D 4
Jesse Lake	97	E 3
Johnsburg	31	F 7
Johnson	54	B 5
Jordan	1,494	E 6
Judson	153	D 6
Kabetogama	28	F 2
Kanaranzi	100	B 7
Kandiyohi	293	D 5
Karlstad	804	B 2
Kasota	600	D 6
Kasson	1,353	F 6
Keewatin	1,807	E 3
Kelliher	336	D 3
Kellogg	409	G 6
Kelly Lake	700	F 3
Kelsey	15	F 3
Kennedy	480	B 2
Kenneth	119	B 7
Kensington	354	C 5
Kent	178	B 4
Kenyon	1,651	E 6
Kerkhoven	664	C 5
Kerrick	81	F 4
Kettle River	223	E 4
Kiester	541	E 7
Kilkenny	174	E 6
Kimball	479	D 5
Kimberly	35	E 4
Kinbrae	85	C 7
Kingsdale	72	F 4
Kingston	140	D 5
Kinmount		F 2
Kinney	336	F 3
Klossner	88	D 6
Knapp	6	D 5
Knife River	375	G 4
Kragnes	25	B 3
Kroschel	25	E 4
La Crescent	1,229	G 7
La Prairie	88	*E 3
La Salle	144	D 6
Lac qui Parle	100	B 5
Lafayette	438	D 6
Lake Benton	863	B 6
Lake Bronson	438	B 2
Lake City	3,457	F 6
Lake Crystal	1,430	D 6
Lake Elmo	386	F 6
Lake Fremont (Zimmerman)	169	E 5
Lake George	95	D 3
Lake Henry	97	D 5
Lake Hubert	125	D 4
Lake Itasca	50	C 3
Lake Lillian	358	C 6
Lake Netta		E 5
Lake Park	689	B 4
Lake Shore	326	D 4
Lake Wilson	434	B 7
Lakefield	1,651	C 7
Lakeland	43	F 6
Lakeside	23	D 6
Lakeville	628	E 6
Lakewood	917	G 4
Lamberton	1,208	C 6
Lamoille	50	G 6
Lamson	20	D 5
Lancaster	536	B 2
Lanesboro	1,100	G 7
Lansing	240	F 7
Laporte	189	D 3
Larsmont	185	G 4
Lastrup	158	D 4
Lauderdale	1,033	G 5
Lawler	75	E 4
Lawndale	25	B 4
Le Center	1,314	E 6
Le Roy	959	F 7
Le Sueur	2,713	E 6
Leader	20	D 4
Leaf Valley	50	C 4
Lemond	8	E 7
Lengby	206	C 3
Lenora	50	G 7
Leonard	88	C 3
Leoneth (Leonidas)	88	F 3
Leota	250	C 7
Lerdal	26	E 7
Lester Prairie	663	D 6
Lewiston	786	G 7
Lewisville	362	D 7
Libby	17	E 4
Lime Creek	54	C 7
Lincoln	30	D 4
Linden	13	D 6
Lindstrom	729	F 5
Lismore	317	B 7
Litchfield	4,608	D 5
Little Falls	6,717	D 5
Little Marais	50	G 3
Little Rock	28	D 5
Little Sauk	100	D 5
Littlefork	671	E 2
Lockhart	60	B 3
Loman	80	E 2
London	100	E 7
Long Beach	181	C 5
Long Lake	399	F 5
Long Prairie	2,443	D 5
Long Siding	48	E 5
Longville	116	D 4
Lonsdale	510	E 6
Loretto	179	F 5
Louisburg	93	B 5
Lowry	285	C 5
Lucan	246	C 6
Luce	32	C 4
Lutsen	75	F 2
Luverne	3,650	B 7
Luxemburg	66	D 5
Lydia	93	E 6
Lyle	609	F 7
Lyman	10	C 4
Lynd	275	C 6
Lyndale		F 5
Mabel	788	G 7
Madelia	1,790	D 6
Madison	2,303	B 5
Madison Lake	357	E 6
Magnolia	260	B 7
Mahkonce	6	C 3
Mahnomen	1,464	C 3
Mahtomedi	1,375	F 5
Mahtowa	150	F 4
Maine	14	C 4
Makinen	255	F 3
Malmo	58	E 4
Malung	5	C 2
Manannah	50	D 5
Manchester	113	E 7
Manganese	41	*D 4
Manhattan Beach	72	E 4
Manitou	50	D 2
Mankato	18,809	E 6
Mansfield	20	E 7
Mantorville	477	F 6
Maple Bay	110	B 3
Maple Island	175	E 7
Maple Lake	780	D 5
Maple Plain	479	F 5
Mapleton	1,083	E 7
Mapleview	435	*F 7
Marble	867	E 3
Marcell	60	E 3
March	15	B 2
Marcy	18	G 3
Margie	100	E 2
Marietta	380	B 5
Marine on St. Croix	334	F 5
Markham	310	F 3
Markville	100	F 4
Marshall	5,923	C 6
Matawan	59	E 7
Mavie	10	B 2
Max	45	D 3
Mayer	153	E 6
Mayhew Lake	24	D 5
Maynard	507	C 6
Mazeppa	523	F 6
McGrath	135	E 4
McGregor	322	E 4
McIntosh	881	C 3
McKinley	196	F 3
Meadow Brook	21	F 3
Meadowlands	134	F 3
Medford	409	E 6
Medicine Lake	284	G 5
Meire Grove	128	C 5
Melby	75	C 4
Melrose	2,106	D 5
Melrude	109	F 3
Melvin	25	B 3
Menahga	849	C 4
Mendota	243	G 5
Mentor	321	B 3
Meriden	131	E 6
Merrifield	78	D 4
Mesaba		F 3
Middle River	356	B 2
Milaca	1,917	E 5
Milan	561	C 5
Mildred	25	D 4
Millerville	173	C 4
Millville	168	F 6
Milroy	268	C 6
Miltona	150	C 4
Mineral Center	6	G 2
Minneapolis	521,718	E 5
Minneiska	134	G 6
Minneota	1,274	C 6
Minnesota City	201	G 6
Minnesota Falls	150	C 6
Minnesota Lake	609	E 7
Minnetonka Beach	376	*F 5
Mizpah	166	D 3
Moland	23	E 6
Money Creek	150	G 7
Monterey	315	D 7
Montevideo	5,459	C 6
Montgomery	1,913	E 6
Monticello	1,231	E 5
Montrose	300	E 5
Moorhead	14,870	B 4
Moose Lake	1,603	E 4
Mora	2,018	E 5
Morgan	949	D 6
Morningside	1,699	G 5
Morrill	40	E 5
Morris	3,811	C 5
Morristown	533	E 6
Morton	794	C 6
Moscow	25	E 7
Motley	435	D 4
Mound	2,061	E 6
Mound Prairie	8	G 7
Mountain Iron	1,377	F 3
Mountain L.	1,733	D 7
Murdock	393	C 5
Myrtle	136	E 7
Nary	7	D 3
Nashua	181	B 4
Nashwauk	2,029	E 3
Nassau	205	B 5
Naytahwaush	220	C 3
Nebish	35	D 3
Nelson	160	C 5
Nemadji	25	F 4
Nerstrand	228	E 6
Nett Lake		E 2
Nevis	332	D 4
New Auburn	290	D 6
New Brighton	2,218	G 5
New Germany	286	E 6
New London	726	C 5
New Market	193	E 6
New Munich	277	D 5
New Prague	1,915	E 6

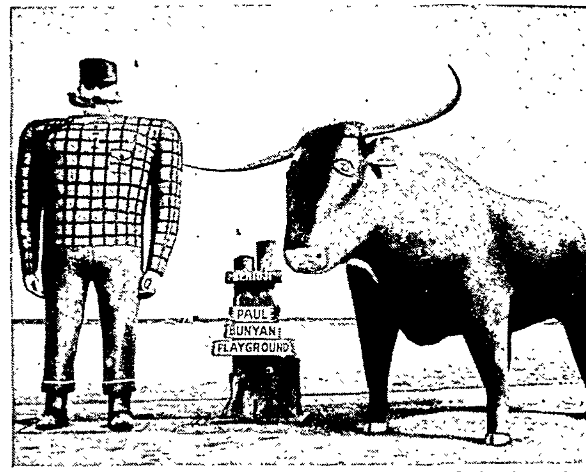
* No room on map for name.

New Richland	908	E 7
New Trier	73	F 6
New Ulm	9,348	D 6
New York Mills	977	C 4
Newburg		G 7
Newfolden	367	B 2
Newhouse	15	G 7
Newport	1,672	F 6
Newry	7	E 7
Nichols	3	E 4
Nickerson	48	F 4
Nicollet	493	D 6
Nielsville	189	B 3
Nimrod	112	D 4
Nisswa	578	D 4
Nodine	50	G 7
Nopeming	474	F 4
Noracres		B 2
Norcross	179	B 5
Norland	5	B 2
Norseland	75	D 6
North Branch	769	F 5
N. Mankato	4,788	D 6
N. Redwood	215	D 6
N. St. Paul	4,248	E 5
Northcote	35	A 2
Northfield	7,487	E 6
Northome	349	D 3
Northrop	157	D 7
Norway Lake	30	C 5
Norwood	749	E 6
Nowthen	18	E 5
Noyes	93	A 2
Oak Center	30	F 6
Oak Island	40	D 1
Oak Park	100	E 5
Oakland	110	E 7
Odessa	283	B 5
Odin	208	D 7
Ogema	249	C 3
Ogilvie	362	E 5
Okabena	236	C 7
Oklee	494	C 3
Olga	7	C 3
Olivia	2,012	C 6
Onamia	704	E 4
Opole	100	D 5
Opstead	18	E 4
Orchard Lake	150	E 6
Org	25	C 7
Orleans	53	B 2
Ormsby	190	D 7
Oronoco	200	F 6
Orr	309	F 2
Orrock	9	E 5
Ortonville	2,577	B 5
Osage	184	C 4
Osakis	1,488	C 5
Oshawa	6	D 4
Oslo	440	A 2
Osseo	1,167	G 5
Ostrander	191	F 7
Otisco	100	E 7
Ottawa	110	E 6
Ottertail	237	C 4
Outing	150	E 4
Owatonna	10,191	E 6
Oylen	35	D 4
Padua	40	C 5
Page	22	E 5
Palisade	212	E 4
Palmdale	12	F 5
Palmers	15	G 4
Palo	700	F 3
Parent	9	D 5
Park Rapids	3,027	D 4
Parkers Prairie	900	C 4
Parkville	500	F 3
Payne	110	F 3
Paynesville	1,503	D 5
Pease	179	E 5
Pelan	30	B 2
Pelican Lakes	154	D 4
Pelican Rapids	1,676	B 4
Pemberton	152	E 7
Penasse	3	C 1
Pencer	11	C 2
Pengilly	75	E 3
Pennington	100	D 3
Pennock	238	C 5
Pequot Lakes	552	D 4
Perham	1,926	C 4
Perley	204	B 3
Petersburg	100	C 7
Peterson	318	G 7
Peyla		F 3
Phelps	15	C 4
Philbrook	100	D 4
Pickwick	122	G 7
Pierz	856	D 5
Pillager	362	D 4
Pilot Grove	24	D 7
Pilot Mound	18	F 7
Pine City	1,937	F 5
Pine Island	1,298	F 6
Pine River	835	D 4
Pinecreek	32	C 2
Pinewood	60	C 3
Pipestone	5,269	B 7
Pitt	12	D 2
Plainview	1,524	F 6
Plato	263	D 6
Pleasant Lake	53	D 5
Plummer	340	B 3
Ponemah	200	D 2
Ponsford	250	C 4
Pontoria	60	D 4
Poplar	12	D 4
Porter	291	B 6
Potsdam	50	F 6
Powderhorn	11,118	G 6
Pratt	43	E 6
Predmore	30	F 7
Preston	1,399	F 7
Priam	14	C 5
Princeton	2,108	E 5
Prinsburg	390	C 6
Prior Lake	536	E 6
Proctor	2,693	F 4
Prosit	227	F 4
Prosper	65	G 7
Providence	8	B 6
Puposky	100	C 3
Quamba	100	E 5
Rabey	30	E 4
Racine	175	F 7
Radium	40	B 2
Rako	9	D 2
Ramey	75	E 5
Randall	425	D 4
Randolph	259	E 6
Ranier	227	E 2
Ranum	2	B 3
Rapidan		D 6
Rauch	95	E 3
Ray	95	E 2
Raymond	580	C 5
Reading	160	C 7
Reads Landing	201	F 6
Red Lake Falls	1,733	B 3
Red Wing	10,645	F 6
Redby	210	D 3
Redlake	350	C 3
Redtop	26	E 4
Redwood Falls	3,813	C 6
Regal	64	D 5
Remer	412	E 3
Renville	1,323	C 6
Revere	198	C 6
Rice	328	D 5
Rice Lake	100	E 5
Richfield	17,502	E 6
Richmond	700	D 5
Richville	141	C 4
Richwood	65	C 4
Ridgeway	50	G 7
River		C 2
Riverton	148	D 4
Robbin	40	A 2
Robbinsdale	11,289	G 5
Roberts	5	B 4
Rochert	120	C 4
Rochester	29,885	F 6
Rock Creek	100	F 5
Rock Dell	41	F 7
Rockford	369	F 5
Rockville	288	D 5
Rogers	268	E 5
Rollag	27	B 4
Rollingstone	315	G 6
Ronneby	72	E 5
Roosevelt	228	C 2
Roscoe	182	D 5
Roscoe	20	F 6
Rose Creek	314	F 7
Roseau	2,231	C 2
Roseland	100	C 6
Rosemount	567	E 6
Rosen	50	B 5
Rosendale	40	D 5
Roseville	6,437	G 5
Rosewood		B 2
Ross	20	C 2
Rothsay	537	B 4
Round Lake	435	C 7
Round Prairie	35	D 5
Royalton	500	D 5
Rush City	1,175	F 5
Rush River	15	D 6
Rushford	1,270	G 7
Rushford (village)	612	*G 7
Rushmore	368	C 7
Russell	508	C 6
Rustad	32	B 4
Ruthton	534	B 6
Rutledge	163	F 4
Sabin	211	B 4
Sacred Heart	745	C 6
Saginaw	51	F 4
St. Anna	12	D 5
St. Anthony	66	D 5
St. Anthony Falls	1,406	G 5
St. Bonifacius	438	F 5
St. Charles	1,548	F 7
St. Clair	324	E 6
St. Cloud	28,410	D 5
St. Francis	125	E 5
St. George	74	D 6
St. Hilaire	276	B 2
St. James	3,861	D 7
St. Joseph	1,246	D 5
St. Kilian	126	C 7
St. Leo	128	C 6
St. Louis Park	22,644	G 5
St. Martin	195	D 5
St. Michael	487	E 5
ST. PAUL	311,349	E 6
St. Paul Pk.	2,438	F 6
St. Peter	7,754	E 6
St. Rosa	69	D 5
St. Stephen	234	D 5
St. Vincent	272	A 2
Salol	55	C 2
Sanborn	613	C 6
Sandstone	1,097	F 4
Santiago	68	E 5
Sargeant	121	F 7
Sartell	662	D 5
Sauk Centre	3,140	C 5
Sauk Rapids	3,410	D 5
Saum	40	D 3
Savage	389	E 6
Sawbill Landing	25	G 3
Sawyer	183	F 4
Scandia	200	F 5
Scanlon	572	F 4
Schley	3	D 3
Schroeder	200	G 3
Seaforth	136	C 6
Searles	102	D 6
Sebeka	802	C 4
Sedan	134	C 5
Shafer	127	F 5
Shakopee	3,185	E 6
Shaw	82	F 3
Sheldon	45	G 7
Shelly	329	B 3
Sherack	14	B 2
Sherburn	1,221	D 7
Shevlin	242	C 3
Shieldsville	28	E 6
Shirley	7	B 3
Shooks	30	D 3
Shoreham	91	C 4
Shotley	35	D 2
Shovel Lake	10	E 4
Side Lake	120	E 3
Silver Creek	104	D 5
Silver Lake	603	D 6
Silverdale	90	E 3
Simpson	92	F 7
Sioux Valley	200	C 7
Skime		C 2
Skyberg	25	F 6
Slayton	1,887	C 7
Sleepy Eye	3,278	D 6
Sobieski	189	D 5
Solana	12	E 4
Solway	124	C 3
Soudan	1,190	F 3
South Branch	698	D 7
South Haven	305	D 5
South International Falls	1,840	E 2
S. St. Paul	15,909	F 6
Spafford	10	C 7
Spicer	566	C 5
Spooner	420	D 2
Spring Grove	1,093	G 7
Spring Hill	91	D 5
Spring Lake	24	E 3
Spring Lake	18	E 5
Spring Park	500	F 5
Spring Vale	25	E 5
Spring Valley	2,467	F 7
Springfield	2,574	C 6
Squaw Lake	132	D 3
Stacy	150	E 5
Stanchfield	100	E 5
Stanton	60	E 6
Staples	2,782	D 4
Star Lake	125	B 4
Starbuck	1,143	C 5
Stark	39	E 5
Steen	228	B 7
Stephen	877	A 2
Sterling Center	22	D 7
Stewart	695	D 6
Stewartville	1,193	F 7
Stillwater	7,674	F 5
Stockton	235	G 6
Storden	398	C 6
Strandquist	208	B 2
Strathcona	143	B 2
Strout	10	D 5
Sturgeon Lake	189	F 4
Sumter	17	D 6
Sunburg	151	C 5
Sundahl	10	B 3
Sunrise	80	F 5
Svea	97	C 6
Swan River	30	E 3
Swanville	373	D 5
Swatara	100	E 4
Swift	40	C 2
Swift Falls	120	C 5
Syre	10	B 3
Tabor	60	B 2
Taconite	322	E 3
Talmoon	25	E 3
Tamarack	132	E 4
Taopi	118	F 7
Taunton	217	B 6
Taylors Falls	520	F 5
Tenney	62	B 4
Tenstrike	206	D 3
Terrace	80	C 5
Terrebonne	50	B 3
Theilman	95	F 6
Thief River Falls	6,926	B 2
Thomson	170	F 4
Thorpe	7	D 6
Tintah	235	B 5
Tobique		E 3
Tofte	100	H 3
Togo	7	E 3
Toimi	100	G 3
Toivola	312	F 3
Tonka Bay	899	F 5
Tower	773	F 3
Tracy	3,020	C 6
Trail	123	C 3
Traverse	15	D 6
Triumph	561	D 7
Trommald	117	D 4
Trosky	140	B 7
Truman	1,106	D 7
Turtle River	57	D 3
Twig	100	F 4
Twin Lakes	124	E 7
Twin Valley	899	B 3
Two Harbors	4,400	G 3
Tyler	1,121	B 6
Ulen	525	B 3
Underwood	336	C 4
Upsala	366	D 5
Urbank	162	C 4
Utica	194	G 7
Vasa	60	F 6
Vawter		D 5
Verdi	101	B 6
Vergas	301	C 4
Vermillion	112	F 6
Verndale	576	C 4
Verndon	40	E 4
Vernon Center	344	D 7
Veseli	132	E 6
Vesta	340	C 6
Victoria	302	E 6
Viking	130	B 2
Villard	288	C 5
Vining	180	C 4
Viola	80	F 6
Virginia	12,486	F 3
Wabasha	2,468	F 6
Wabasso	693	C 6
Waconia	1,569	E 6
Wadena	3,958	C 4
Wahkon	202	E 4
Waite Park	1,639	D 5
Waldorf	266	E 7
Wales	35	G 3
Walker	1,192	D 3
Walnut Grove	890	C 6
Walters	139	E 7
Waltham	212	F 7
Wanamingo	496	F 6
Wanda	178	C 6
Wannaska	66	C 2
Warba	125	E 3
Ward Springs	45	D 5
Warren	1,779	B 2
Warroad	1,276	C 2
Warsaw	150	E 6
Waseca	4,927	E 6
Wasioja	150	F 6
Waskish	40	C 2
Waterford	65	E 6
Watertown	837	E 6
Waterville	1,627	E 6
Watkins	659	D 5
Watson	284	C 5
Waubun	426	C 3
Waverly	493	E 5
Wawina		E 3
Wayzata	1,791	E 6
Weaver	105	G 6
Webster		E 6
Wegdahl	51	C 6
Welch	70	F 6
Welcome	712	D 7
Wells	2,475	E 7
Weme		C 3
Wendell	284	B 4
West Concord	770	F 6
W. St. Paul	7,955	G 5
West Union	100	C 5
West Virginia	175	F 3
Westbrook	1,017	C 6
Westbury	25	C 4
Westport	96	C 5
Whalan	176	G 7
Wheaton	1,948	B 5
Whipholt	100	D 3
White Bear L.	3,646	G 5
White Earth	800	C 3
White Rock	100	F 6
Wig Wam Bay	50	E 4
Wilbert	30	D 7
Wilder	118	C 7
Wildwood	40	E 3
Wilkinson	200	D 3
Willernie	592	H 5
Williams	414	D 2
Willmar	9,410	C 5
Willow Creek	12	D 7
Willow River	294	F 4
Wilmington	15	G 7
Wilmont	473	C 7
Wilson		G 7
Wilton	108	C 3
Windom	3,165	C 7
Winger	283	B 3
Winnebago	2,127	D 7
Winona	25,031	G 6
Winsted	941	D 6
Winthrop	1,251	D 6
Winton	184	G 3
Wirock	20	C 7
Wirt	138	E 3
Witoka		G 7
Wolf Lake	109	C 4
Wolverton	198	B 4
Wood Lake	504	C 6
Woodland	411	*G 5
Woodstock	277	B 7
Worthington	7,923	C 7
Wrenshall	148	F 4
Wright	199	E 4
Wrightstown	23	C 4
Wyattville	26	G 7
Wykoff	509	F 7
Wylie	10	B 3
Wyoming	325	F 5
York	6	F 7
Young America	365	E 6
Yucatan	15	G 7
Zemple	87	*E 3
Zim	110	F 3
Zimmerman	169	E 5
Zumbro Falls	172	F 6
Zumbrota	1,686	F 6

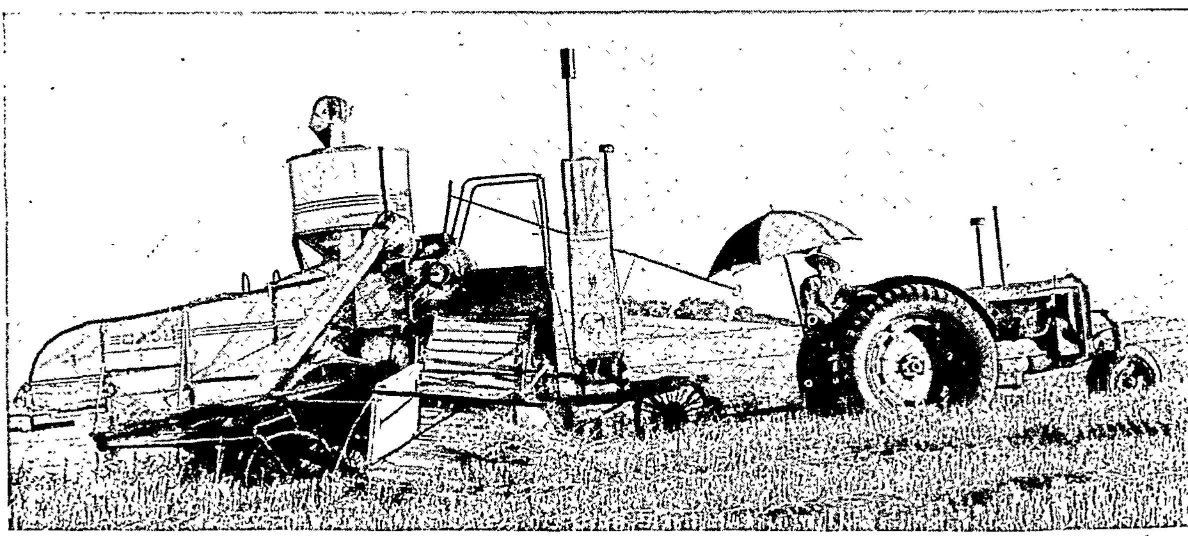
*No room on map for name.



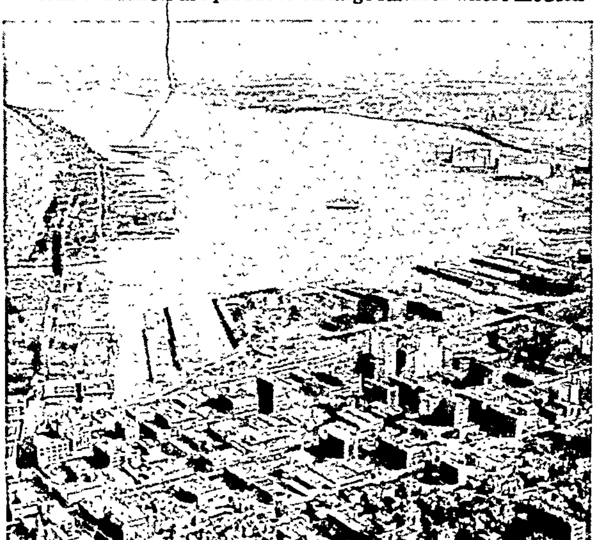
One of northern Minnesota's special industries is supplying Christmas trees. The trees are hauled from the woods on drays.



A tourist attraction at Bemidji are statues of the legendary hero of the lumberjacks, Paul Bunyan, and Babe the Blue Ox.



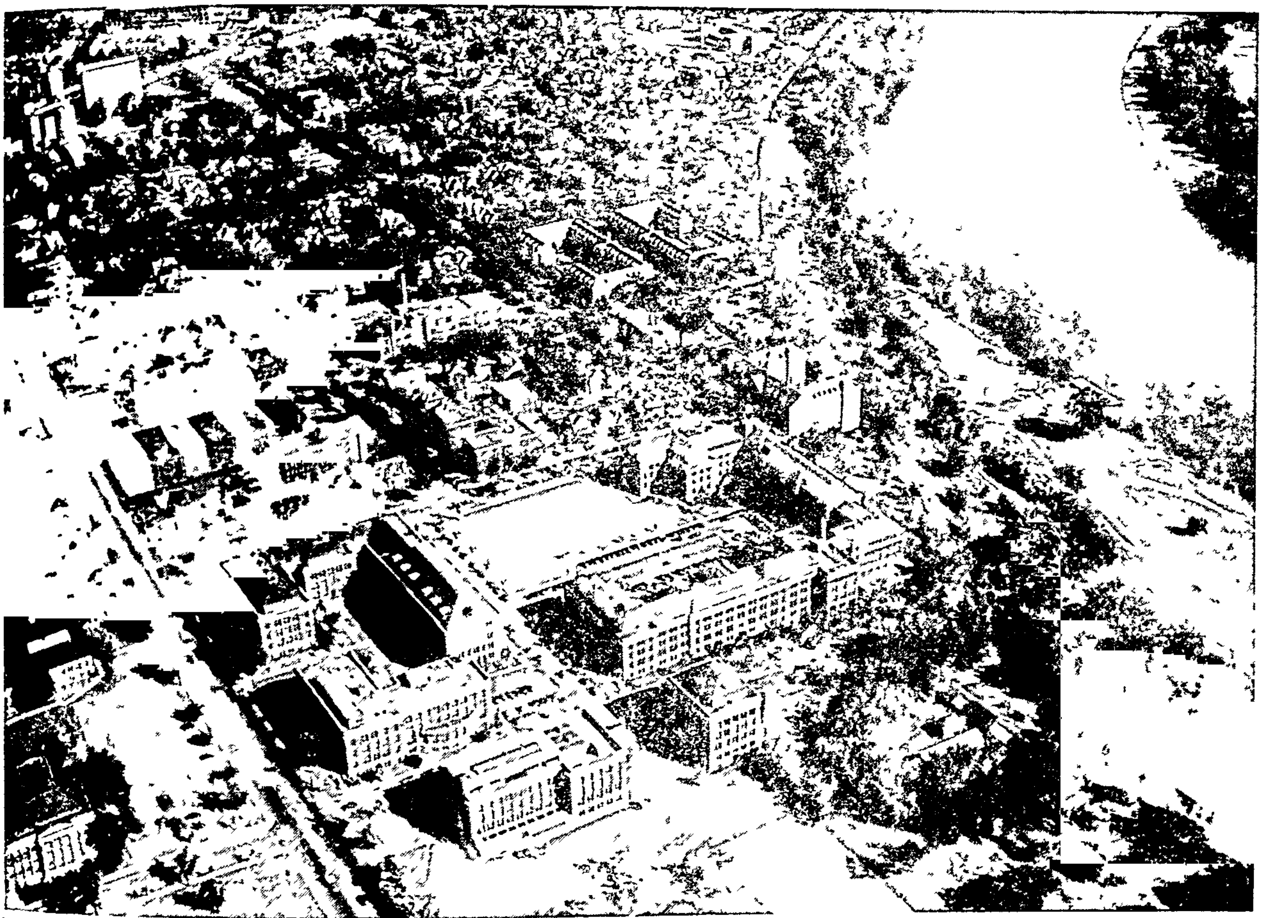
Wheat is an important farm crop in southeastern Minnesota. Millions of bushels are produced on large ranches where modern farm machinery can do much of the work. This tractor and combine are harvesting a field of golden grain near Lake City.



At the head of Lake Superior is the bustling port city of Duluth. The long neck of land at the left is Minnesota Point.

The livestock yards and meat-packing plants of South St. Paul are among the largest and busiest of their kind in the nation.

AIR VIEW OF THE UNIVERSITY OF MINNESOTA



In a bend of the Mississippi River in Minneapolis stands the University of Minnesota. It is one of the top-ranking universities in student enrollment in the nation. This picture shows the southern end of its 194-acre campus. The larger building to the right is the University Hospital, with the halls devoted to the medical and biological sciences grouped around it.

other eminent men, voyaged over the Great Lakes and landed at Fond du Lac. From there they started the arduous trip inland up the St. Louis River to Sandy Lake, the trading post of the American Fur Company. Stopping at Cass Lake, which they had discovered in 1820, they paddled up the Mississippi, portaging most of the way. Finally they reached Lake Itasca, one of the sources of the Mississippi. Schoolcraft named the lake from parts of two Latin words, *veritas*, meaning "truth," and *caput*, meaning "head"—"true head."

Made Territory in 1849

In 1837 the Indians ceded all their land east of the Mississippi to the United States. In 1849, when Minnesota was organized as a territory, it had a population of almost 5,000. This was the beginning of its development and prosperity. Lumber companies started work in many parts of the state, and settlers flocked from the east and abroad. Minnesota was admitted to the Union as a state on May 11, 1858.

In the Civil War the new state sent about 22,000 men to the Federal cause in addition to fighting a war of its own, the Sioux Indian uprising. Led by Chief Little Crow, the Sioux massacred about 350 people in 1862. They were defeated at Wood Lake and were removed the next year to lands beyond the Missouri. (*See also* Minnesota Fact Summary; United States, section "North Central Region.")

MINT. The fragrant herb called mint is named for the beautiful nymph Mintha. In Greek mythology, Persephone, in a fit of jealousy, turned Mintha into the plant now highly prized for its odor and flavor. The popular mint flavors come from an oil in the leaves.

There are many kinds of mint. In North America alone there are 12 species and many varieties. Among the best known are spearmint, or garden mint, used for flavoring chewing gum, sauces, and beverages, such as tea; peppermint, used as a flavor for candy; and Japanese mint, from which menthol is made for medicines. Other common mints are bergamot, whose lemon-scented leaves are used in perfume, and pennyroyal, which is used in medicine.

When the first flowers appear, the mint is cut with scythes or mowing machines, partially cured like hay, and then distilled. Menthol, however, is separated from Japanese mint by freezing and centrifuging.

Oregon and Washington supply about two thirds of the peppermint oil produced in the United States. Other producers are Indiana, Michigan, Wisconsin, California, and Ohio. Most spearmint oil comes from Indiana and Michigan. Mint is also raised in Brazil, Japan, China, England, and continental Europe.

The mints belong to the family *Labiatae* or *Lamiaceae*. Plants of this family have square stems bearing opposite leaves. Among them are many other fra-

grant herbs, such as sage, thyme, savory, balm, basil, marjoram, lavender, rosemary, and hyssop. Catnip, or catmint (*Nepeta cataria*), is also in this family. Cats eat it with relish and it is also used to make a medicinal tea. The mints themselves make up the genus *Mentha*. These perennial herbs grow in many parts of the world. They have clusters of small pink, purple, or white flowers and creeping rootstocks. The scientific name of spearmint is *Mentha spicata;* of peppermint, *Mentha piperita;* of pennyroyal, *Mentha pulegium.*

Where Uncle Sam MAKES METAL *into* MONEY

MINT, UNITED STATES. If we ask "Where does our money come from?" the answer is, "from the mint"—if the money is in nickels, quarters, silver dollars, or other metal coin. Government mints are the only places authorized to make metallic money.

"Making money" is only one activity of the United States government mints. Miners sell their precious metals to the mints. Jewelers and others needing considerable quantities of precious metal get their supplies from the mints, or from dealers who obtain the metal from the mints. Importers and exporters of gold and silver deal, directly or indirectly, with the mints. The mints are, in general, Uncle Sam's "business agents" for managing all governmental interests in the precious metals which are used in making money.

To see how money is made, let us visit the Philadelphia mint, since it is the largest. This mint occupies a huge building patrolled day and night by armed guards. After we have visited the museum and viewed its fine collection of ancient and modern coins, medals, and curios from many lands, a guide leads us through some of the ever-busy departments. We see the die-cutting department, which provides all the United States mints with the dies for stamping the designs on coins. In a branch of this department all medals of a national character—such as the Distinguished Service Cross—are manufactured. We also get a glimpse of the many steel-lined vaults for the storage of coin and bullion. One has a floor space of 5,200 square feet and a storage capacity of 112,000,000 silver dollars—and it has often been filled almost to capacity with sacks of these coins! These vaults were made of more than 3,250,000 pounds of steel, and have special time-lock attachments.

Making Money

The departments that interest us most are those where the coins are made. From glass-enclosed galleries we may watch the carefully guarded machines minting United States coins or turning out a run of metal money for some Latin American country that has no mint of its own.

Precious metal for coinage comes in bars, called "bullion." These bars are cast to contain exactly the right amount of alloy needed to make the coin durable when passed from hand to hand in everyday use. Silver is alloyed with one part of copper to nine of silver. After the bar has been tested by assaying, it is melted, and the molten metal is cast into ingots. These are passed 18 or 20 times through hardened steel rollers until they become strips just thick enough so that each coin cut from them will have the right weight. The strips are fed through cutting machines, which have vertical punches acting like biscuit cutters. Each punch bites out 225 coin blanks, or *planchets*, a minute. Each planchet is inspected and weighed by automatic scales; then it goes to a milling machine. Here a revolving wheel forces up a "lip" around the edge.

Now each blank is annealed, or softened, by heating until cherry red, then chilling in cold water. These processes usually oxidize some of the copper, producing a dirty film, which is removed by an acid bath. After being cleaned, the blanks are ready for coining. In the coining room the blanks drop through tubes into the coining presses. Automatic "fingers" center them between two powerful dies, one for the "obverse"—the side bearing the date—and one for the "reverse." The dies come together with a pressure of 100 tons to the square inch (for large coins), making a perfect impression. "Milling" is done by cutting grooves around the raised edge. Finished coins clatter into a pan, 80 to 120 a minute. After final inspection and weighing, they are placed in canvas sacks for storage, or for delivery to the Treasury or to banks through the Federal Reserve system.

Coining in Olden Days

These precise modern methods are an immense improvement on early ways of making money. In Asia Minor and the ancient city-states of Greece, coins were usually made by "striking" the smooth gold or silver blanks between engraved dies of bronze or hardened iron or steel. One of the dies bore the design for the face and the other that for the back of the coin. Only rarely were coins cast in molds; and today casting is the sure sign of the counterfeiter. Beautiful specimens of the ancient coiner's art in our museums are the joy and wonder of every true artist.

In the Middle Ages the same methods were employed—striking engraved dies or punches upon the metal with a hammer. The blanks were prepared at times by casting, and at times by hammering the metal into sheets on an anvil and cutting out the disks with shears or a round punch. Hand hammering was superseded by the mill and screw press about 1662. The "milled" edge was adopted to protect the coin against being clipped and to make stacking easier. Modern machinery was developed in the 19th century.

Problems in Making Money

Modern methods owe much of their success to secret methods, especially in alloying. To prevent loss of precious metal, even floor sweepings are treated. One particularly difficult problem has been making pennies that would not tarnish. The French solved this difficulty accidentally, when they melted

church bells for copper after the Revolution of 1789. The bell metal (95 per cent copper, 4 per cent tin, and 1 per cent zinc) proved to be an excellent "coinage bronze."

American mints are controlled by a branch of the Treasury Department called the Bureau of the Mint, with a director in charge. Coins are made at the mints in Philadelphia and Denver. These mints also assay precious metals and buy gold and silver bullion. The Bureau also has assay offices in New York City and at the former San Francisco mint, which was closed in March 1955. Gold is kept on deposit at Fort Knox, Ky., and silver at West Point, N. Y.

Congress established the United States Mint on April 2, 1792, as a separate department of the government. It came under the Treasury Department in 1873. The first United States money, copper pennies, was coined in 1793. Silver dollars were made the next year, and gold eagles ($10 pieces) in 1795. The largest gold pieces coined were six hundred $50 pieces struck as mementos of the Panama-Pacific International Exposition. (*See also* Counterfeiting; Money.)

Mirabeau ((*mē-rä-bō'*), **Count** (1749–1791). To the noblemen of France, in 1789, the brilliant but dissolute Honoré Gabriel Riqueti Mirabeau must have seemed a traitor to their class, for in the Estates-General of that year, to which he was elected, he acted as a leader of the Third Estate, or common people. But Mirabeau had learned by personal experience something of the evils of the old government; and when the nobility refused to elect him as a representative, he turned to the Third Estate, that he might not be deprived of helping in the changes so badly needed.

Mirabeau's father, an eccentric nobleman, heartily disliked him because of his ugly face, scarred by smallpox, and the wild life of his youth. Several times the father had secured from the king orders for the imprisonment of his wayward son, possibly to keep him out of mischief, and one of Mirabeau's first writings was against these arbitrary arrests by *lettres de cachet*.

In the Estates-General, Mirabeau first attracted attention by openly defying the king. Louis XVI had sent a command to the members of the Third Estate for them to retire from the hall in which they were sitting to their old separate place of meeting. But Mirabeau replied to the messenger: "Go tell your master that we are here by the will of the people, and that we shall be removed only at the point of the bayonet." From this time his influence in the assembly was great. His fire and dash, and his stirring words, won for him the titles of the "Tribune of the People" and the "French Demosthenes."

His statesmanship, however, saw clearly the dangerous direction in which the Revolution was going. In order to save the country from impending disasters, he undertook secretly to advise the king with counsels of moderation. But the king and queen detested Mirabeau because of his former life and because he took money for his advice, and they refused to be guided by his counsels. Thus his attempt to establish a constitutional monarchy, such as England had, failed. He was elected president of the famous "Jacobin Club" in 1790, and shortly afterward president of the National Assembly.

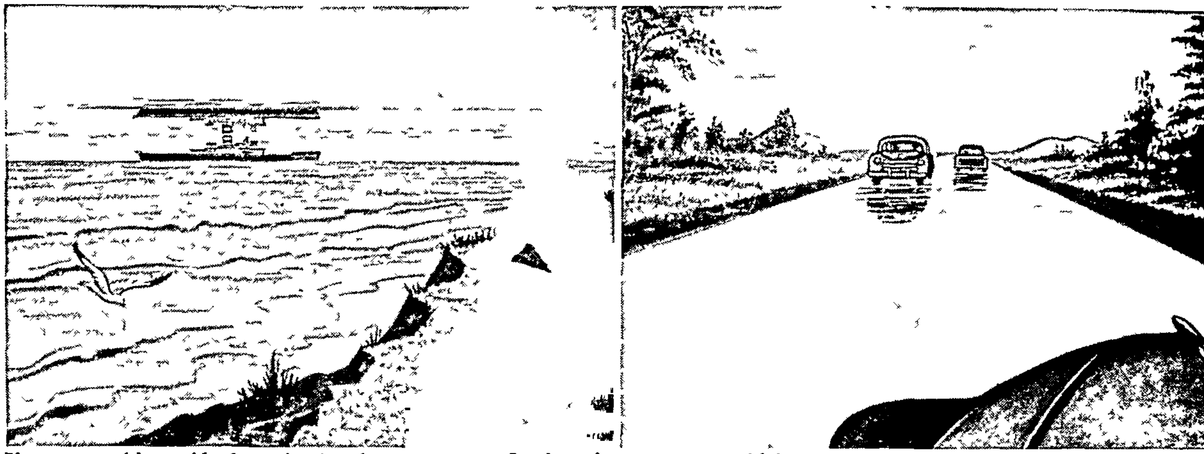
At length, worn out by his work and his dissipations, Mirabeau died in 1791. His death removed the only statesman who could have guided the Revolution through the coming troublous times, a fact which Mirabeau clearly recognized when he exclaimed just before his death: "I carry with me the ruin of the French monarchy."

Miracle plays. In the Catholic church the celebration of the Mass and the special services for the festivals have many dramatic elements. In the Middle Ages these services were made more popular and more instructive by the use of living pictures, or tableaux,—as, for instance, the representation of the Child in the Manger surrounded by the Wise Men. It was a natural step from tableau to acting, first in dumb show, and then with appropriate songs and dialogues. This was the origin of the "mysteries" and "miracle plays." As far back as the 10th century we find simple plays of this kind, though the earliest play mentioned by the name is the 'Play of St. Katherine' produced in England in the 12th century.

At first the language used was Latin, but later this was changed to the language of the people—English or French or German, as the case might be. As the plays grew in length and elaborateness, they were transferred from the church to the churchyard, and then to the village streets. Once outside the church, secular and comic elements were added. In the 13th century these plays came little by little to be taken from the hands of the clergy, and by the latter part of the 14th century they were acted almost entirely by the different guilds, or unions of craftsmen. These guilds went from street to street with large wagons, called "pageants," on which they set up a stage with rude scenery. The Creation, Noah and the Flood, Adam and Eve, Abraham and Isaac, and other stories of the Old Testament were presented, as well as incidents in the life of Christ. Strictly speaking, these representations of stories from the Bible were the mysteries, while the miracle plays dealt with the lives of the saints, but this distinction was not always observed. Closely associated with these plays were the *moralities*, in which moral lessons were taught by representing virtues and vices as persons. One of these old plays, entitled 'Everyman', has been successfully revived.

Most of these plays, which originated as a means of religious and moral instruction, became so corrupted by jests and vulgarities that they were condemned by the church, and after the 15th century almost ceased to be given. But the pure type of mystery is still preserved in the beautiful Passion Play, which is presented once in every ten years in Oberammergau in upper Bavaria. (*See* Drama.)

SEEING THINGS THAT ARE NOT THERE



If we see a ship upside down in the sky or watery reflections from a concrete highway on a hot dry day we are viewing a mirage. Scientists call the one a superior mirage and the other an inferior mirage. The article explains what causes them.

MIRAGE (*mĭ-razh'*). Stories are often told of thirsty desert travelers being lured by a "mirage" of an oasis with green trees and quiet water. The traveler runs forward, according to the common version of the story, and tries to throw himself into the shady pool. At this moment the vision disappears, leaving him once more on the desert sand under the burning sun, far from water. Picturesque as such stories may be, they are all untrue. Travelers see such visions only in their imaginations, if they see them at all. Real mirages do exist, nevertheless, and they take a variety of remarkable forms.

Mirages are caused by the bending, or *refraction*, of light rays by the atmosphere. A certain amount of bending always occurs and we do not think of its effects as a mirage. Standing by the ocean, an observer can often see ships or other objects which in reality are below his horizon.

The explanation of this phenomenon is simple. The atmosphere is heaviest and densest at the surface of the earth. Its density decreases upward, the air becoming rarer farther from the earth. This makes the atmosphere behave as a great prism which is thickest at its base. Like such a prism it bends all light rays downward (*see* Light). Rays reflected from a distant ship may be bent down toward the observer on the shore. He then sees the ship clearly even though the curvature of the earth is between him and the ship. This normal refraction usually goes unnoticed and we do not realize that an object is actually below our physical horizon.

Sometimes, however, the same effect is intensified and we get a type of mirage called *looming*. This occurs when the density gradient of the air—the rate at which it becomes thinner away from the earth—is greater than normal. At such times, an observer on the shore of a big lake or a wide strait may see the distant shoreline which is normally invisible. In Chicago, for example, people can sometimes see the eastern shore of Lake Michigan across the water. The sand dunes of this shore are much too far away to be seen normally, even in the clearest weather.

Often associated with looming is what is called a *superior mirage*. A ship, for example, may be seen sailing upside down above the horizon. Below this inverted image the real ship can usually be seen, but it may be out of sight below the horizon. A superior mirage is caused by a layer of cool, dense air hanging some distance above the surface of the water. The inverted image reaches the observer through this *inversion layer*. Rays of light from the upper part of the ship are bent down more sharply than are rays from the lower part. This has the effect of forming an upside-down image of the ship. Still other layers above may form multiple images. An alternate explanation of the superior mirage is that the under surface of the inversion layer acts as a mirror and forms an inverted image by reflection. Most scientists, however, feel that this surface is too uneven to form an image in such a way and that the image is formed by refraction.

Probably the most common type of mirage is the *inferior mirage*, seen frequently in summer over flat, heated surfaces. An automobile on the highway ahead of us may seem to be traveling through a shallow pool of water which forms a ripply reflection of the car. The explanation of this mirage is the reverse of the superior mirage. In this case, there is a thin layer of heated and thus rarefied air close to the hot pavement. Light rays from the automobile entering this layer are bent upward, and the inverted image is seen below the car. Inferior mirages are often seen in desert country where they appear as pools of water. The "water" is simply the image of the sky and it disappears as the observer approaches. This mirage probably gives rise to the fanciful stories of elaborate mirages seen on the desert.

Most famous of all mirages is the Fata Morgana, seen over the Strait of Messina between Italy and Sicily. This mirage, named for the legendary sorceress Morgan le Fay, takes the form of weird castles which rise from the sea and change their shape, towering into the air or compressing themselves into a thin line. The Fata Morgana is a complex mirage, probably

formed by looming and a combination of superior and inferior images. Constantly changing layers of air distort and magnify the image of the cliffs and houses on the opposite shore into the turreted castles of the sorceress. Similar mirages in other places are also given the name Fata Morgana.

Riflemen, target-shooting on a hot day, speak of the apparent quivering of the target as mirage. This is caused by unequally heated air rising from the ground between the marksman and the target. Moving strands of air act as lenses or prisms and distort the light rays reflected by the target. If we light a match and look at an object through the heated air above its flame, the object is similarly distorted. "Heat devils" seen in open country and "heat waves" over hot radiators are explained in the same way.

MIRRORS. When we think of a mirror, we have in mind a looking glass. But the word "mirror" takes in a variety of smooth surfaces called *reflectors*, which reflect light rather than absorb it. Large plate-glass mirrors are often used to give spaciousness to a room. Automobiles have rear-view mirrors for safety. A pocket flashlight, a searchlight, and a lighthouse beacon use specially curved mirrors to produce strong beams. A dentist uses a small mirror to concentrate light on one spot. Some telescopes and microscopes have mirrors to focus light on an object.

How a Mirror Reflects Light

Light is reflected from a mirror in much the same way that a rubber ball bounces from a wall. When a light ray hits the surface of the mirror in a straight line, it bounces back along the same line. When it strikes the mirror at an oblique angle, it bounces back in another direction, at an angle equal to the one at which it struck the surface. The first angle is called the *angle of incidence;* the second is called the *angle of reflection.* These two angles are always equal in all types of mirrors.

Plane and Curved Mirrors

Mirrors are classified as *plane* or *curved.* A plane mirror has a flat surface. It is used whenever a true image is desired. Curved mirrors produce distorted images. Amusement parks use them to make people look tall and thin, or short and fat. Curved mirrors are either *concave* or *convex.*

A looking glass is a plane mirror. Like most other mirrors, it consists of a piece of glass with a coating of silver nitrate on the back. The silver backing keeps the light from passing through the glass. When you stand before a looking glass, the light rays reflected from your body strike the mirror, and bounce back to your eyes. Therefore you see a clear image of yourself. But you look as though you are behind the mirror. The image you see is called a *virtual* image, because the light rays appear to come to a focus behind the mirror. Your right hand appears to be left, and everything else is reversed from one side to the other. This reversal is the distinguishing feature of any so-called "mirror image."

A *concave mirror* is shaped like part of the inner surface of a sphere. When light waves strike such a mirror, they bounce back and meet at a point in front of the mirror. This point is called the *principal focus.* If you stand outside the principal focus, your image is larger than you are and you appear upside down. But if you move closer to the mirror, inside the principal focus, your image is enlarged but you are erect. Such an image is virtual.

A *convex mirror* looks like a part of the outer surface of a sphere. No matter where you stand, this mirror makes you look smaller. Such an image is erect and virtual. Rear-view mirrors are often convex.

The MAGNOLIA STATE—*Its Cotton, Corn, and Timber*

MISSISSIPPI. A wealth of natural resources gives Mississippi the foundation for a well-balanced economy. Here are abundant sunshine and rainfall, a mild climate and long growing season, and rich soil. Here too are thousands of acres of forests, deposits of nonmetallic minerals, and ample fish and game.

For more than a century Mississippi was almost entirely dependent upon cotton. Now it has broadened its agricultural production by adding a variety of crops as well as livestock raising and dairying. Most of this diversification occurred between 1930 and 1935. During this period the state reduced its cotton acreage by one-third; and increased its food and feed crop acreage and number of cattle by two-thirds. Mississippi has also achieved better balance between its agriculture and manufacturing industries. Favorable state legislation and new uses for farm products and waste materials have greatly stimulated its industrial production.

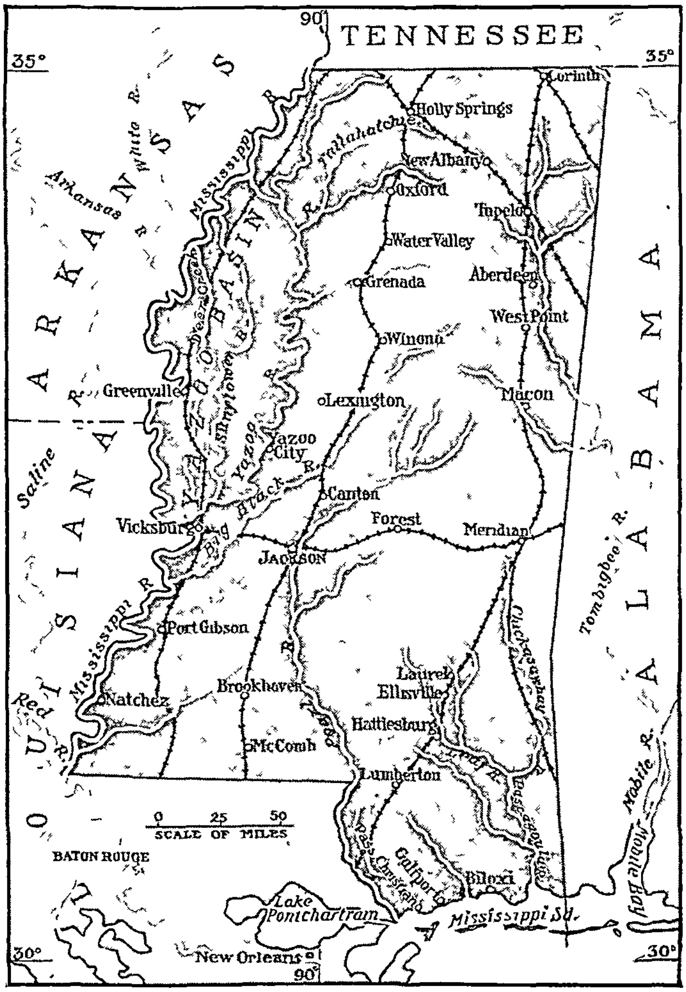
Mississippi's Distinct Natural Regions

Almost all Mississippi lies in the low Coastal Plain of the Gulf of Mexico. Its elevation varies only slightly from sea level in the south to hills of less than a thousand feet high in the northeast. In spite of this relatively uniform surface the state has several distinct natural regions.

In the northwestern part of the state, between the Mississippi and Yazoo rivers, is the great alluvial plain or delta. It extends some 200 miles northward from Vicksburg and has an average width of about 65 miles. Built up through the ages by successive floods of the rivers, it is one of the most fertile areas in the world. A continuous line of dikes along the rivers protects the bottomlands from floods. This region was long famous for its fine long-staple cotton. For years this was the sole crop, but the ravages of the boll weevil finally made crop rotation necessary. Now corn, soybeans, velvet beans, alfalfa, and other forage crops are grown extensively. Stock raising is also an important industry. Much of the land is held in large plantations, owned by whites and worked chiefly by Negroes.

East of the delta, and extending the length of the state, is a belt of low brown loam or *loess* hills.

MISSISSIPPI'S NETWORK OF RIVERS



The western half of the state is drained by the Mississippi River and two of its tributaries, the Yazoo and the Big Black. To the east, the Pearl and the Pascagoula flow into the Gulf of Mexico. The Tombigbee rises in the northeast but flows most of its course in Alabama. The extreme northeastern boundary is formed by the Tennessee River.

Extensive cotton planting and heavy cutting of forests have led to considerable erosion damage.

East of the loess soil area, and occupying the northern two thirds of the state, is a series of low, rolling hills. Just east of the loess region lie the North Central Hills. At one time this area produced little besides cotton. Now a variety of crops are grown and short-leaf pine forests are being replanted. Still farther to the east is the Black Prairie, a rolling grassy region that provides abundant hay and pasturage for a thriving dairying industry. In the northeast corner of the state are the Tennessee River Hills, an extension of the southern division of the Appalachian Highlands. Near Iuka, Woodall Mountain rises to 806 feet, the highest elevation in the state.

In the southeastern portion the land is much flatter. Along the Gulf of Mexico are the Coastal Meadows, a low, swampy region not suitable for farming. Here the tourist trade is the chief industry, for mild winters bring many visitors to enjoy the fine fishing and other sports. To the north lies Piney Woods, a sandy area covered with slash and long-leaf pine forests. Fruit, pecan, and tung orchards and truck farms are found here. At the northern edge of this region is Jackson Prairie, a narrow strip of fertile land.

The Climate Benefits Agriculture

A favorable climate has helped make agriculture the chief industry of Mississippi. The atmosphere is humid, and the average annual rainfall is about 54 inches. Generally mild temperatures prevail throughout the state, averaging 80° F. in summer and 48° in winter. Pastures are green for nine or ten months of the year. The frost-free growing season is seldom less than 200 days except in the extreme northern part of the state.

Mississippi usually raises more cotton than any other state except Texas. Less acreage is devoted to cotton than in the past but improved farming methods have increased the yield per acre from 187 pounds to more than 300. Corn is the second most important crop, followed by hay, sweet potatoes, and oats. Other valuable products are soybeans, tung nuts, fruit, and truck-garden crops. "Scrub" cattle and razorback hogs have been largely replaced by high-grade stock. Many farm products are marketed by co-operative methods.

Other Products of the Magnolia State

Second to agriculture in importance are the industries connected with lumber. Nearly a thousand sawmills and planing mills turn out about 1½ billion board feet of lumber each year. The state ranks first in softwood distillation. This includes the production of turpentine, rosin, pitch, tar, and other naval stores. Another related industry is the manufacture of pulp, paper, and paperboard. Other important manufactured goods are cottonseed oil, food products, and men's and boys' clothing.

Manufacturing in Mississippi was encouraged by the Balance Agriculture with Industry (BAWI) law of 1936 (re-enacted 1944). It authorized communities to issue bonds for new industrial plants and exempted certain industries from taxation for five years.

Mississippi's most valuable mineral is petroleum. Most of the output comes from oil fields in Yazoo, Lincoln, Adams, Lamar, Marion, and Jasper counties. The yearly value of petroleum production accounts for nine tenths of all the value obtained from Mississippi's minerals. In 1948 a record of 46 million barrels was produced. Natural gas is increasing in importance. Most of it comes from gas fields in the south-central part of the state. Other minerals are natural-gas liquids, sand and gravel, and clays.

Mississippi's Leading Cities

The capital and largest city of the Magnolia State is Jackson. It is the manufacturing center, for a rich agricultural and lumbering district (*see* Jackson). To the east lies Meridian, also an industrial center, in a fruit, dairy, livestock, and lumber area.

Continued on page 306

Mississippi Fact Summary

MISSISSIPPI (Miss.): Probably named from two Indian words with various spellings, meaning "the great river."

Nickname: "Magnolia State," from the many magnolia trees growing there.

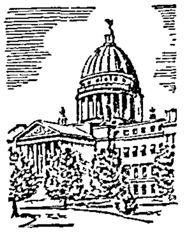
Motto: Virtute et Armis (By Valor and Arms).

Seal: An American eagle with outspread wings is upon a silver circular field. The eagle holds a bundle of three arrows in its right claw and a fruited olive branch in its left claw, symbolic of war and peace. At the base of the seal is a five-pointed star.

Flag: For description and illustration, *see* Flags.

Flower: Magnolia. **Bird:** Mockingbird. **Tree:** Magnolia. **Song:** 'Way Down South in Mississippi'—words, Verne Barnes; music, Josie Gautier.

THE GOVERNMENT



Capital: Jackson (since 1822).

Representation in Congress: Senate, 2; House of Representatives, 6. Electoral votes, 8.

State Legislature: Senators, 49; term 4 years. Representatives, 140; term, 4 years. Convenes Tuesday after first Monday in January in even-numbered years. No limit to length of legislative session.

Constitution: Adopted 1890. Proposed amendment must be (a) passed by a two-thirds vote of each legislative house on 3 separate days and (b) ratified by a majority vote at a general election.

Governor: Term, 4 years. May not succeed himself.

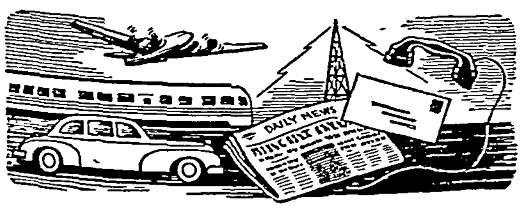
Other Executive Officers: Lieutenant governor, secretary of state, attorney general, treasurer, auditor, all elected; terms, 4 years.

Judiciary: Supreme court—9 justices, 3 elected from each district; term, 8 years. Circuit courts—17 circuits. Chancery courts—16. County courts—13. Circuit, chancery, county judges—all elected; term, 4 years.

County: 82 counties, each governed by a board of supervisors made up of 5 members. Boards and officers elected; terms, 4 years.

Municipal: Mayor and board of aldermen plan most common; some municipalities have commission plan.

Voting Qualifications: Age, 21; residence in state, 2 years; in district, 1 year. Literacy test. Poll tax assessed on all citizens 21–60 years of age except if exempted.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 3,700 miles. First railroad, Vicksburg to Beech Wood (Vicksburg and Clinton R. R.), 1838. Rural roads, 61,800 miles. Airports, 86.

Communication: Periodicals, 27. Newspapers, 141. First newspaper, *Mississippi Gazette*, Natchez, 1799 or 1800. Radio stations (AM and FM), 47; first station, WDBT (now WFOR), Hattiesburg, licensed May 1, 1925. Television stations, 1; WJTV, Jackson, began operation Jan. 1, 1953. Telephones 268,500. Post offices, 706.

THE PEOPLE AND THEIR LAND

Population (1950 census): 2,178,914 (rank among 48 states—26th); urban, 27.9%; rural, 72.1%. Density: 46.1 persons per square mile (rank—28th state).

Extent: Area, 47,716 square miles, including 468 square miles of water surface (31st state in size).

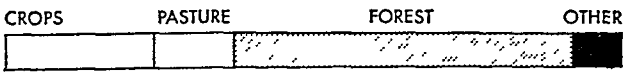
Elevation: Highest, Woodall Mountain near Iuka, 806 feet; lowest, sea level.

Temperature: (°F.): Average—annual, 65°; winter, 48°; spring, 64°; summer, 80°; fall, 66°. Lowest recorded, —16° (Batesville, Feb. 2, 1951, and other locations and dates); highest, 115° (Holly Springs, July 29, 1930).

Precipitation: Average (inches)—annual, 54; winter, 16; spring, 15; summer, 13; fall, 10. Varies from about 48 in northwest to about 64 in southeast.

Natural Features: Flat, swampy region along Gulf of Mexico; slash and longleaf pine forests in southern part of state. A rich delta with fertile soil extends north from junction of Yazoo and Mississippi rivers. In the north-central section is the rich loam of the North Central Hills. A fertile prairie belt lies along the eastern boundary. Principal rivers: Big Black, Mississippi, Pascagoula, Pearl, Tombigbee, Yazoo.

Land Use: Cropland, 24%; nonforested pasture, 13%; forest, 55%; other (roads, parks, game refuges, wasteland, cities, etc.), 8%.



Natural Resources: *Agricultural*—long growing season, mild climate, adequate rainfall, rich soil. *Industrial*—petroleum and natural-gas fields, vast pine forests, deposits of sand and gravel, clay, and stone. *Commercial*—Mississippi River as a waterway; historic sites attract vacationists.

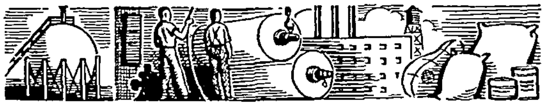
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Agriculture, forestry, and fishery..	305,052	42.5
Wholesale and retail trade.......	95,592	13.3
Manufacturing................	90,338	12.6
Personal services (hotel, domestic, laundering, etc.)	57,075	8.0
Professional services (medical, legal, educational, etc.)..........	45,248	6.3
Construction................	36,455	5.1
Transportation, communication, and other public utilities.......	30,764	4.3
Government.................	18,004	2.5
Business and repair services......	11,134	1.6
Finance, insurance, and real estate.	9,127	1.3
Amusement, recreation, and related services..............	3,650	0.5
Mining....................	3,617	0.5
Workers not accounted for.......	10,795	1.5
Total employed..............	716,851	100.0

Mississippi Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—37th)
Value added by manufacture* (1952), $351,722,000

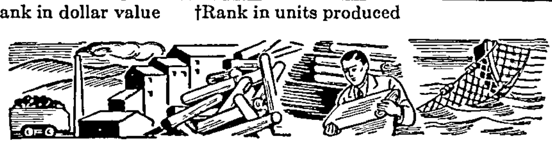
Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
LUMBER AND PRODUCTS	$87,595,000	7
PAPER AND ALLIED PRODUCTS. Pulp, paper, and paperboard mills	36,463,000	23
CHEMICALS AND ALLIED PRODUCTS. Softwood distillation; cottonseed oil mills	35,342,000	27
FOOD AND KINDRED PRODUCTS. Soft drinks; bakery products; dairy products; ice; animal feeds	33,889,000	37
APPAREL AND RELATED PRODUCTS. Men's and boys' furnishings	25,563,000	22
TEXTILE MILL PRODUCTS	17,667,000	24

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—23d)
Total cash income (1952), $555,500,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Cotton lint	1,644,000 bales	1	2
Corn	44,756,000 bu.	2	19
Milk	626,000,000 qts.	3	26
Cottonseed	680,000 tons	4	2
Hogs	194,336,000 lbs.	5	23
Cattle	226,367,000 lbs.	6	26
Hay	1,088,000 tons	7	31
Eggs	45,000,000 doz.	8	27
Chickens	53,940,000 lbs.	9	27

*Rank in dollar value †Rank in units produced



C. Fish (Rank among states—14th)
(Marine waters and coastal rivers, 1950), 84,138,500 lbs.—value, $3,371,000; (Mississippi River and tributaries, 1950), 7,677,000 lbs.—value, $1,082,000

D. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $103,030,000
Rank among states—25th

Minerals (1951)	Amount Produced	Value
Petroleum	37,039,000 bbls.	$82,970,000
Natural gas	158,845,000,000 cu. ft.	10,007,000
Clays	673,000 tons	4,250,000
Natural-gas liquids	1,202,000 bbls.	3,355,000
Sand and gravel	3,012,000 tons.	2,279,000

E. Lumber (Rank among states—7th)
1,447,000,000 board feet (5-year average)

F. Trade

Trade (1948)	Sales	Rank among States
Wholesale	$ 957,915,000	33
Retail	1,008,334,000	34
Service	71,706,000	35

EDUCATION

Public Schools: Elementary, 3,268; secondary, 759 Compulsory school age, 7 through 15. Ex Officio State Board of Education consists of state superintendent, secretary of state, and attorney general. The state superintendent is chairman of the board; he is elected for 4-year term and is eligible for indefinite succession. County school boards are elected for 6-year terms. County superintendents are elected for 4-year terms, but county may change to appointive method by a petition. In cities: board or commission select school boards for 5-year terms; superintendents elected for 4-year terms.

Private and Parochial Schools: 61.

Colleges and Universities (accredited): Colleges—white, 10; Negro, 6. Junior colleges—white, 18; Negro, 7. State-supported schools include University of Mississippi, University; Mississippi State College, State College; Mississippi State College for Women, Columbus; 2 teachers colleges—Delta State Teachers College, Cleveland; and Mississippi Southern College, Hattiesburg; 3 Negro colleges—Alcorn Agricultural and Mechanical College, Alcorn; Jackson College, Jackson; and Mississippi Vocational College, Itta Bena.

Schools for the Handicapped: Miss. School for the Blind, Miss. School for the Deaf, School for Spastics, all at Jackson; Ellisville State School, Ellisville.

Libraries: City-county public libraries in 57 counties serve entire counties. Independent city libraries, 1. State Library Commission responsible for aid in developing public library service; work headed by director. State Department of Education responsible for aid in developing school library service; work headed by library supervisor. Noted special libraries: State Department of Archives and History, State Library, and State Board of Health Library; all in Jackson.

Outstanding Museums: State Museum, Jackson; Lauren Rogers Library and Museum of Art, Laurel; Mary Buie Museum, Oxford.

CORRECTIONAL AND PENAL INSTITUTIONS

Columbia Training School, Columbia; Oakley Training School, Oakley; State Penitentiary, Parchman.

STATE PARKS*

Clarkco—area wooded with pine, oak, dogwood, and redbud; spring-fed lake near Meridian (14).

Holmes County—beautiful forest setting for lake well stocked with fish; near Durant (8).

Leroy Percy—fishing and boating on bayous of typical delta land; first state park (1936); near Hollandale (7).

Percy Quinn—picnicking and camping facilities in area surrounding large lake; near McComb (18).

Roosevelt—near Morton; well-marked trails; swimming and boating on Roosevelt Lake (11).

Shelby—growth of oak, pine, dogwood, redwood trees; lake stocked with fish; near Hattiesburg (20).

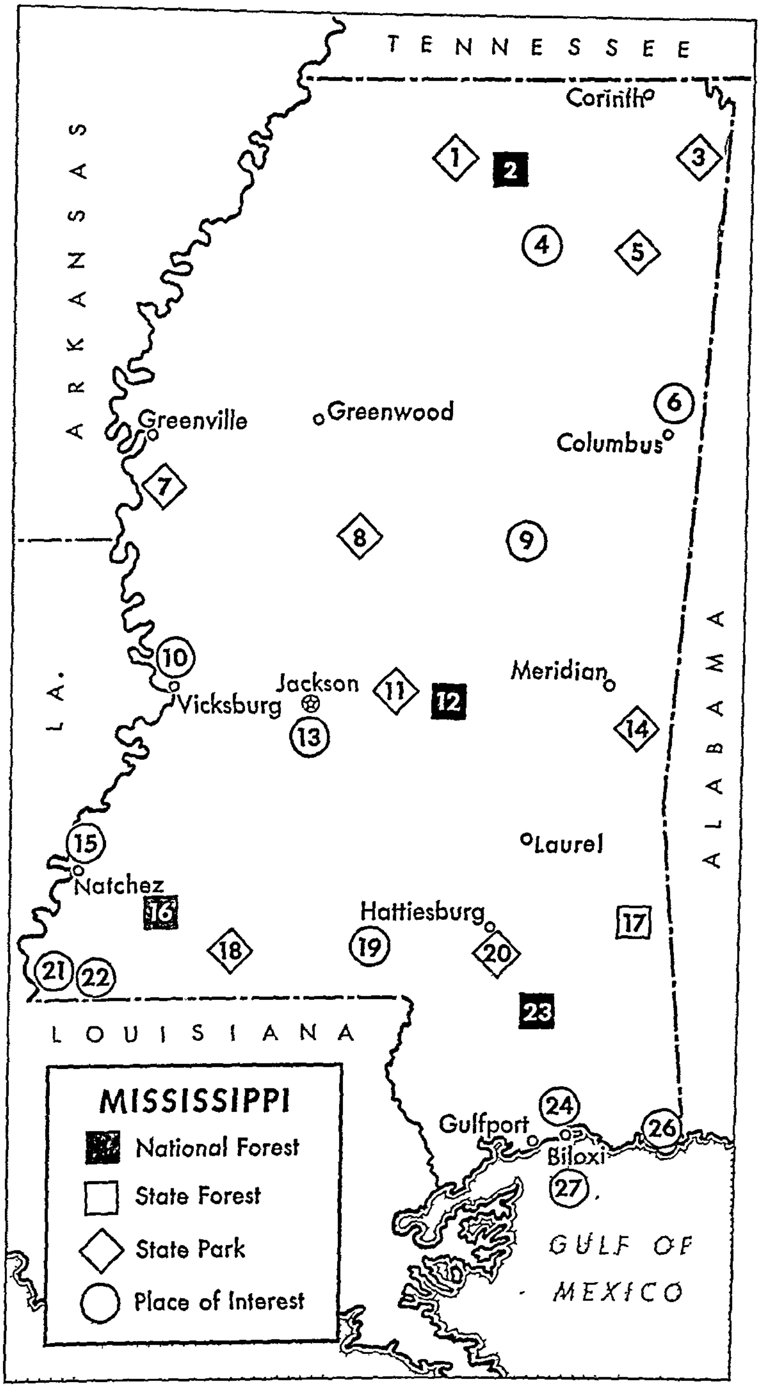
Spring Lake—clear, spring-fed lake; picnic area; spacious lodge; near Holly Springs (1).

Tishomingo—near Tishomingo; named after Choctaw Indian chief; overhanging cliffs and caves once used by Tishomingo Indians; wild flowers and shrubs (3).

Tombigbee—near Tupelo; swimming, boating, and game fishing on lake; forested rolling country (5).

*Numbers in parentheses are keyed to map.

Mississippi Fact Summary



STATE FORESTS*

University Forest Lands (Stone County)—23,000 acres; southeast of symbol (23).
W.W. Kurtz (Greene County)—1,760 acres (17).

NATIONAL FORESTS*†

Bienville—382,820 acres (12).
De Soto—1,213,740 acres (23).
Holly Springs—462,040 acres (2)
Homochitto—373,495 acres (16).

PLACES OF INTEREST*

Ackia Battleground National Monument—here British and Indian allies defeated the French and their Indian allies (1736) (4).
Arkabutla Reservoir—dam on Coldwater River for flood control; fishing; west of (1).
Ashwood—home of George Poindexter; first Mississippi law code was written here (1822); near Woodville (22).
Biloxi—first permanent white settlement in lower Miss Valley (1699); Beach Boulevard and beaches extend for miles; large shrimp port; nearby Beauvoir was Jefferson Davis' last residence, now Confederate shrine (24).
Brices Cross Roads National Battlefield Site—Gen. Nathan B. Forrest skillfully led Confederate cavalry (1864) northeast of (4).
Enid Reservoir—flood control dam on Yocona River; fishing; southwest of symbol (4).
Fort Adams—post of Gen. James Wilkerson, notorious for part in Burr conspiracy (21).
Fort Massachusetts on Ship Island—Civil War fort and prison (27).
Franklin Academy—first public school in Mississippi (1821); at Columbus (6).
Grenada Reservoir—dam on Yalobusha River controls floods; fishing; southwest of (4).
Jackson—Old Capitol, built 1833-42; scene of Jefferson Davis' last public appearance; State Capitol (1903); zoo (*see* Jackson) (13).
John Ford Home—here Pearl River Convention asked for statehood; nr. Columbia (19).
Nanih Waiya—sacred "mother mound" of Choctaw Indians near Noxapater (9).
Natchez—pre-Civil War mansions; gardens; replica of Fort Rosalie (15).
Natchez Trace National Parkway—follows historic Indian trail between Nashville and Natchez; about 450 miles when completed (15).
Pascagoula—De la Point Fort, old Spanish fort built 1718; shipyards; fishing (26).
Sardis Reservoir—dam on Little Tallahatchie River; flood control for Yazoo Basin; fishing; northwest of (4).
Selsertown Indian Mound—largest mound in state; near Washington and Natchez (15).
Tupelo National Battlefield Site—commemorates battle of Tupelo, July 13-14, 1864; southeast of (4).
Vicksburg—Civil War buildings; shell-scarred Old Court House Museum; Vicksburg National Military Park preserves fortifications of siege of city (1863); giant model of Mississippi River at nearby U. S. Waterways Experiment Station; Vicksburg National Cemetery to north (see Vicksburg, Battle of) (10).
Washington—second territorial capital (1802-17); first state capital (1817-21) (15).

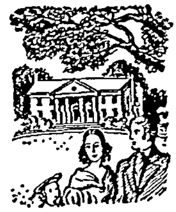
*Numbers in parentheses are keyed to map.
†Headquarters of each national forest is at Jackson.

LARGEST CITIES (1950 census)

Jackson (98,271): state capital and industrial center; manufactures furniture, lamps, textiles, chemicals.
Meridian (41,893): in agricultural and livestock area; railroad shops; makes clothing, hosiery, wood products.
Biloxi (37,425): gulf resort; sea-food canning; shipping.
Greenville (29,936): river port; lumber and paper, cotton, and concrete products; rugs; chemicals.
Hattiesburg (29,474): commercial hub of southern Miss.; chemicals, naval stores, clothing, lumber products.
Vicksburg (27,948): historic Mississippi River port; market and shipping center for lumber, cattle, cotton.
Laurel (25,038): Masonite, lumber milling, cotton products.
Natchez (22,740): river port, cotton market; paper mills.
Gulfport (22,659): resort; port; shirts; forest products.
Greenwood (18,061): cotton market, cottonseed products.

Mississippi Fact Summary

THE PEOPLE BUILD THEIR STATE



1540—Hernando de Soto is first European to explore what is now Mississippi.

1629—First English claim to northern Mississippi region based on Carolina grant made by Charles I; claim is repeated in grant of Charles II, 1663.

1682—René Robert Cavelier, Sieur de La Salle, descends Mississippi River, claims Mississippi Valley for France; Father Zenobius Membre says first mass on Mississippi soil near site of Fort Evans.

1699—Pierre le Moyne, Sieur d'Iberville, builds Fort Maurepas near present site of Biloxi with help of Biloxi Indians; government of French Louisiana located here until moved to Mobile in 1702.

1712—Antoine Crozat receives control of Louisiana from French government; gives up control, 1717.

1716—Jean Baptiste le Moyne, Sieur de Bienville, establishes Fort Rosalie on site of present Natchez; fort destroyed by Indians, 1729.

1717—John Law organizes Western Company (later named Company of the Indies) to develop resources of French Louisiana for Louis XV; wild financial speculation follows; "Mississippi Bubble" bursts in 1720 when company fails.

1726—Bienville is recalled; Perier becomes commander-general; his harsh rule retards growth of colony.

1729—French demand that Natchez Indians surrender their lands; Natchez attack French, who retaliate, 1730, and scatter the tribe; Yazoo Indians also attack and are annihilated by the French.

1732—Georgia grant repeats British claim to northern Mississippi. British work with Chickasaw Indians to drive out French from northern area.

1763—By Treaty of Paris, Great Britain gains possession of "West Florida," the area east of the Mississippi River and south of the 31st parallel; northern boundary later moved to 32° 30′N.

1764—British rebuild Fort Rosalie (Natchez); name it Fort Panmure.

1772—English settlers at about this time establish first schools in area near Natchez and Vicksburg.

1779—Spaniards re-enter Gulf country; occupy Natchez, 1781.

1783—Treaty of Paris sets United States western boundary at Mississippi River; southern boundary set at 31st parallel (northern limits of Florida). Spain refuses to accept 31st parallel as border.

1785—Georgia organizes disputed territory in southern Mississippi area as Bourbon County; sells it to four land companies in "Yazoo Fraud," 1795.

1795—By treaty, Spain accepts 31st parallel as Mississippi-Florida boundary; but Spanish remain until U. S. troops arrive, 1798.

1798—Mississippi Territory organized, April 7; capital, Natchez; governor, Winthrop Sargent; territory bounded by Mississippi River on the west, Chattahoochee River on the east, 31st parallel on the south, and parallel running through the mouth of the Yazoo River on the north.

1801—U. S. treaty with Chickasaw Indians gains government right of way on the Natchez Trace.

1802—Territorial capital moved to Washington, in Adams County.

1804—Country between Yazoo line of 1798 and Tennessee boundary added to Mississippi Territory.

1806—Cotton of Mexican type introduced to Mississippi, greatly increasing cotton production.

1811—*New Orleans* is first steamboat on Mississippi R.

1812—Area between Pearl and Perdido rivers south of 31st parallel added to Mississippi Territory.

1814—In War of 1812, U. S. gunboats engage British barges in battle of Lake Borgne near Pass Christian.

1817—Mississippi admitted to the Union, December 10 (eastern part of territory becoming Alabama); capital, Washington; governor, David Holmes. Tunica Indians migrate to Louisiana.

1819—Jackson Military Road opened from Nashville; runs through Mississippi to New Orleans.

1820—By Treaty of Doak's Stand, October 18, Choctaw Indians cede to U. S. most of their land in central Mississippi; Choctaws surrender remainder of their land by Treaty of Dancing Rabbit Creek, 1830, and are moved to Oklahoma.

1822—Jackson becomes state capital, January 23.

1832—Chickasaw Indians cede to U. S. more than 6,000,000 acres of land in northeastern Mississippi.

1834—Vicksburg Company chartered to build rail line from Vicksburg to Jackson.

1844—University of Mississippi chartered, February 24; opens at Oxford, 1848.

1861—Mississippi secedes from Union, January 9; Jefferson Davis of Wilkinson County becomes president of the Confederate States.

1862—Union troops occupy Corinth, Iuka, Holly Springs, and Oxford.

1863—Jackson captured by Union forces, May 13; state government flees to Columbus, then to Macon (Miss.). Vicksburg surrenders, July 4, after long siege. Sherman marches across state from Vicksburg to Meridian, 1863, causing devastation.

1865—Constitutional convention abolishes slavery.

1866—State legislature refuses to ratify 13th and 14th Amendments to U. S. Constitution; Mississippi placed under military rule, 1867.

1869—Mississippi adopts new state constitution, inaugurating "carpetbagger" government, finally overthrown in 1875.

1870—Mississippi readmitted to the Union, February 7.

1878—State Agricultural and Mechanical College (now Mississippi State College) founded at Starkville.

1890—Present state constitution adopted, November 1.

1903—New State Capitol building completed.

1908—Importation and sale of alcoholic liquors is prohibited.

1909—Boll weevil invades state, causing wide damage to cotton crop.

1924—State Education Commission established.

1927—Mississippi River's worst flood sweeps Mississippi delta country; federal flood control measures begin in 1928; check future floods.

1931—Jackson natural-gas field opened.

1933—Tennessee Valley Authority, established by Congress, increases supply of electric power to northern Mississippi.

1936—Balance Agriculture With Industry (BAWI) law promotes new industries in state; re-enacted, 1944.

1948—Workmen's Compensation Law enacted. State gives votes to States' Rights party.

1950—William Faulkner of Oxford awarded Nobel prize (1949 award) for literature.

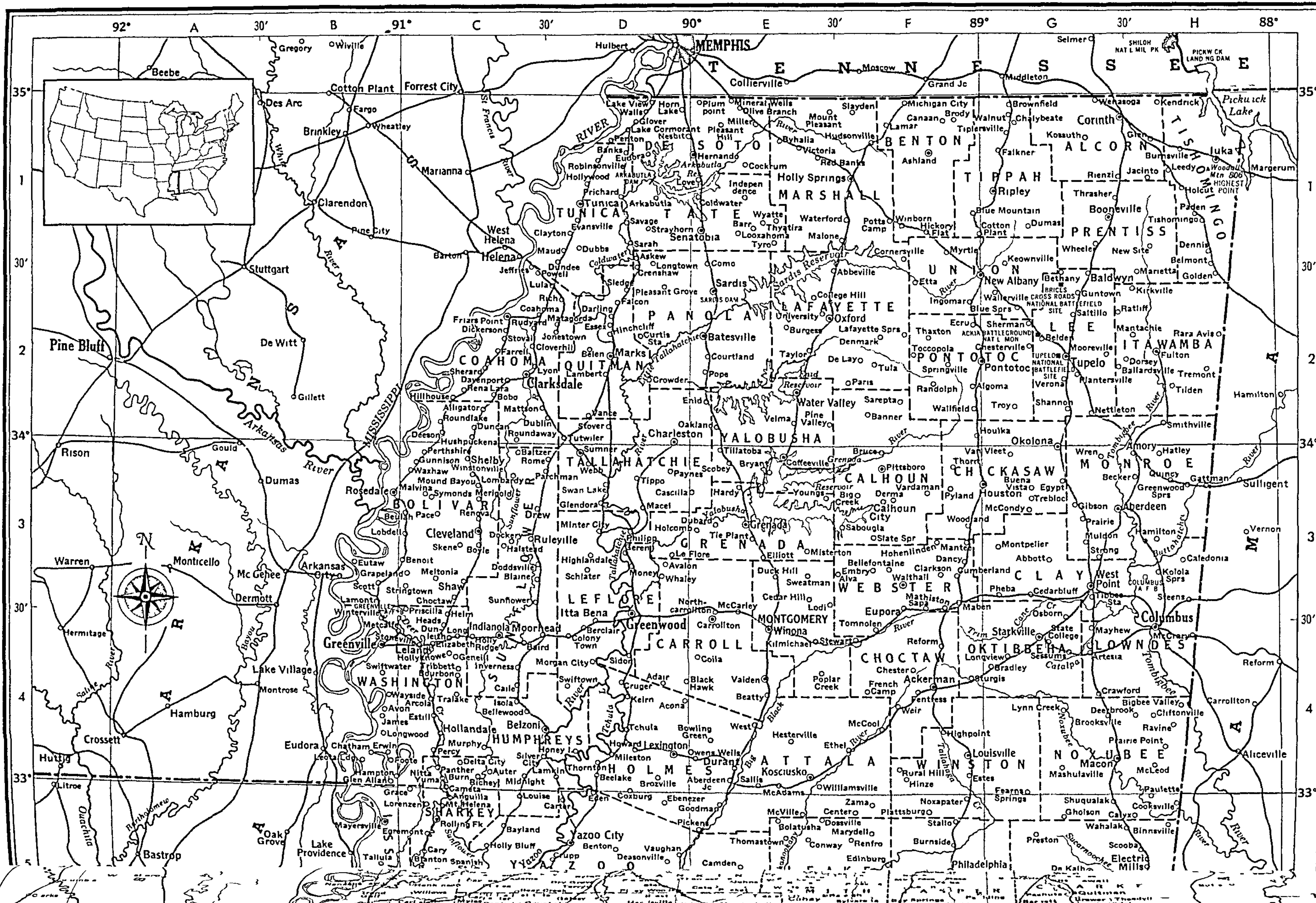
1953—Since BAWI plan began in 1936, about 100 industries established under it.

COUNTIES

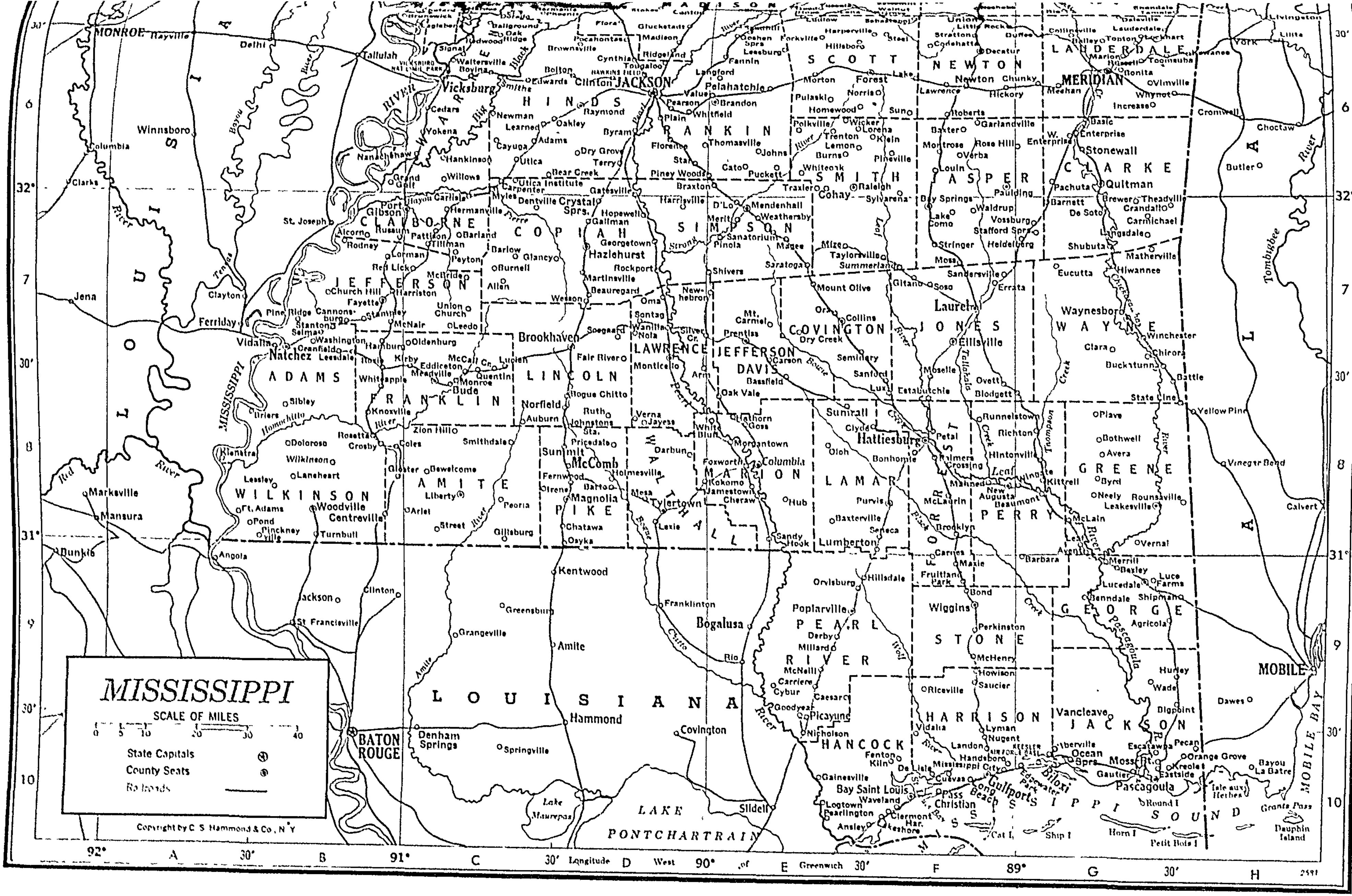
Adams	32,256	B 8
Alcorn	27,158	G 1
Amite	19,261	C 8
Attala	26,652	E 4
Benton	8,793	F 1
Bolivar	63,004	C 3
Calhoun	18,369	F 3
Carroll	15,499	E 4
Chickasaw	18,951	G 3
Choctaw	11,009	F 4
Claiborne	11,944	C 7
Clarke	19,362	G 6
Clay	17,757	G 3
Coahoma	49,361	C 2
Copiah	30,493	D 7
Covington	16,036	E 7
De Soto	24,599	E 1
Forrest	45,055	F 8
Franklin	10,929	C 8
George	10,012	G 9
Greene	8,215	G 8
Grenada	18,830	E 3
Hancock	11,891	E 10
Harrison	84,073	F 10
Hinds	142,164	D 6
Holmes	33,301	D 4
Humphreys	23,115	C 4
Issaquena	4,966	B 5
Itawamba	17,216	H 2
Jackson	31,401	G 9
Jasper	18,912	F 6
Jefferson	11,306	B 7
Jefferson Davis	15,500	E 7
Jones	57,235	F 7
Kemper	15,893	G 5
Lafayette	22,798	E 2
Lamar	13,225	E 8
Lauderdale	64,171	G 6
Lawrence	12,639	D 7
Leake	21,610	E 5
Lee	38,237	G 2
Leflore	51,813	D 3
Lincoln	27,899	D 8
Lowndes	37,852	H 4
Madison	33,860	D 5
Marion	23,967	E 8
Marshall	25,106	E 1
Monroe	36,543	H 3
Montgomery	14,470	E 4
Neshoba	25,730	F 5
Newton	22,681	F 6
Noxubee	20,022	G 4
Oktibbeha	24,569	G 4
Panola	31,271	E 2
Pearl River	20,641	E 9
Perry	9,108	G 8
Pike	35,137	D 8
Pontotoc	19,994	F 2
Prentiss	19,810	G 1
Quitman	25,885	D 2
Rankin	28,881	E 6
Scott	21,681	E 6
Sharkey	12,903	C 5
Simpson	21,819	E 7
Smith	16,740	E 6
Stone	6,264	F 9
Sunflower	56,031	C 3
Tallahatchie	30,486	D 3
Tate	18,011	E 1
Tippah	17,522	G 1
Tishomingo	15,544	H 1
Tunica	21,664	D 1
Union	20,262	F 2
Walthall	15,563	D 8
Warren	39,616	C 6
Washington	70,504	C 4
Wayne	17,010	G 7
Webster	11,607	F 3
Wilkinson	14,116	B 8
Winston	22,231	F 4
Yalobusha	15,191	E 2
Yazoo	35,712	D 5

CITIES AND TOWNS

Abbeville	250	F 2
Abbott		G 3
Aberdeen	5,290	H 3
Aberdeen Junction		E 4
Ackerman	1,463	F 4
Acona	250	D 4
Adair		D 4
Adams	40	C 6
Agricola	200	G 9
Alcorn	500	B 7
Algoma	165	G 2
Allen		C 7
Alligator	214	C 2
Alva		F 3
Amory	4,990	H 3
Anding	140	D 5
Anguilla	601	C 5
Ansley	65	E 10
Arcola	413	C 4
Ariel	19	C 8
Arkabutla	207	D 1
Arm	135	D 8
Artesia	594	G 4
Ashland	328	F 1
Askew		D 1
Auburn	200	C 8
Auter	25	C 4
Avalon		D 3
Avent		G 8
Avera	40	G 8
Avon	175	C 4
Bailey	35	G 6
Baird	193	C 4
Baldwyn	1,567	G 2
Ballardsville	30	H 2
Ballground	300	C 5
Baltzer	250	C 3
Banks		D 1
Banner	125	F 2
Barbara	50	G 9
Barland	10	C 7
Barlow	60	C 7
Barnett	250	G 7
Barr	275	E 1
Barto	25	D 8
Basic		G 6
Bassfield	320	E 8
Batesville	2,463	E 2
Battle		H 8
Baxter		F 6
Baxterville	80	E 8
Bay St. Louis	4,621	F 10
Bay Springs	1,302	F 7
Bayland		C 5
Bear Creek		D 6
Beatty	50	E 4
Beaumont	1,200	G 8
Beauregard	231	D 7
Becker	300	G 3
Bee Lake		D 4
Belden	360	G 2
Belen		D 2
Bellefontaine		F 3
Bellewood	75	C 4
Belmont	814	H 1
Belzoni	4,071	C 4
Benndale		G 9
Benoit	444	C 3
Benton	225	D 5
Bentonia	496	D 5
Berclair	100	D 4
Bethany		G 2
Beulah	342	B 3
Bewelcome		C 8
Bexley		G 9
Big Creek	147	F 3
Big Point	300	H 9
Bigbee Valley	51	H 4
Biloxi	37,425	G 10
Binnsville	50	H 5
Black Hawk	100	E 4
Blaine	200	C 3
Blanton		C 5
Blodgett	5	F 8
Blue Mountain	875	G 1
Blue Springs	125	G 2
Bobo		C 2
Bogue Chitto	375	D 8
Bolatusha	50	E 5
Bolton	741	D 6
Bond	500	F 9
Bonhomie		F 8
Bonita		G 6
Booneville	3,295	G 1
Bothwell		G 8
Bourbon		C 4
Bovina	82	C 6
Bowling Green	28	E 4
Boyle	799	C 3
Bradley		G 4
Brandon	1,827	E 6
Braxton	206	D 6
Brewer	50	G 7
Briers		B 8
Brody		F 1
Brookhaven	7,801	C 7
Brooklyn	500	F 8
Brooksville	819	G 4
Brownfield	300	G 1
Brownsville	50	D 6
Brozville	25	D 4
Bruce	1,719	F 3
Brunswick	150	C 5
Bryant	150	E 3
Bucatunna	500	G 7
Bude	1,195	C 8
Buena Vista	50	G 3
Burgess		E 2
Burnell	30	C 7
Burns	213	E 6
Burnside	75	F 5
Burnsville	525	H 1
Byhalia	581	E 1
Byram		D 6
Byrd		G 8
Caesar	50	E 9
Caile	150	C 4
Caledonia	252	H 3
Calhoun City	1,319	F 3
Calyx	150	G 5
Camden	350	E 5
Cameta	89	C 4
Canaan		F 1
Cannonsburg		B 7
Canton	7,048	D 5
Carlisle	350	C 7
Carmichael		G 7
Carnes		F 8
Carpenter	150	C 6
Carriere	500	E 9
Carrollton	475	E 4
Carson	206	E 7
Carter		D 5
Carthage	1,925	E 5
Cary	390	C 5
Cascilla	108	D 3
Cato		E 6
Cayuga		C 6
Cedar Hill		E 3
Cedarbluff	130	G 3
Cedars	65	C 6
Center		F 5
Centreville	2,025	B 8
Chalybeate		G 1
Charleston	2,629	D 2
Chatawa	240	D 8
Chatham	30	B 4
Cheraw	100	E 8
Chester		F 4
Chesterville	40	G 2
Chicora	500	G 7
Choctaw		C 3
Chotard		C 5
Chunky	258	G 6
Church Hill		B 7
Clara	450	G 7
Clarksdale	16,539	D 2
Clarkson	150	F 3
Clayton	350	D 1
Clermont Harbor	175	F 10
Cleveland	6,747	C 3
Cliftonville	300	H 4
Clinton	2,255	D 6
Cloverhill	200	C 2
Clyde		E 8
Coahoma	300	C 2
Cockrum		E 1
Coffeeville	739	E 3
Cohay		E 6
Coila		E 4
Coldwater	949	E 1
Coles		C 8
College Hill		E 2
Collins	1,293	E 7
Collinsville		G 6
Colony Town	175	D 4
Columbia	6,124	E 8
Columbus	17,172	H 3
Como	703	E 1
Conehatta	50	F 6
Conway		E 5
Cooksville		H 5
Corinth	9,785	G 1
Cornersville		F 1
Cotton Plant	125	G 1
Courtland	275	E 2
Coxburg		D 5
Crandall	145	G 7
Cranfield	20	B 7
Crawford	374	G 4
Crenshaw	740	D 2
Crosby	1,152	B 8
Crowder	476	D 2
Cruger	494	D 4
Crupp	135	D 5
Crystal Springs	3,676	D 7
Cuevas	150	F 10
Cumberland		F 3
Curtis Station		D 2
Cybur		E 9
Cynthia		D 6
Daleville	125	G 5
Dancy		F 3
Darbun		D 8
Darling		D 2
Davenport	75	C 2
De Kalb	953	G 5
De Lay	200	F 2
De Lisle	600	F 10
De Soto		G 7
Deasonville	50	D 5
Decatur	1,225	F 6
Deemer		F 5
Deerbrook		G 4
Deeson		C 2
Delta City	250	C 4
Denmark	50	F 2
Dennis	158	H 1
Dentville		C 7
Derby		E 9
Derma	494	F 3
D'Iberville	1,429	G 10
Dickerson	100	C 2
Dixon	100	F 5
D'Lo	516	E 7
Dockery	25	C 3
Doddsville	201	C 3
Doloroso		B 8
Dorsey	58	H 2
Dossville	150	E 5
Drew	1,681	C 3
Dry Creek		E 7
Dry Grove		D 6
Dubard	20	E 3
Dubbs		D 1
Dublin		C 2
Duck Hill	537	E 3
Duffee	65	G 6
Dumas	187	G 1
Duncan	436	C 2
Dundee	250	D 1
Dunleith		C 4
Durant	2,311	E 4
Eaglebend	38	C 5
Eastside	1,215	H 10
Ebenezer	95	D 5
Ecru	494	F 2
Eddiceton		C 8
Eden	306	D 5
Edgewater Park	500	G 10
Edinburg	900	F 5
Edwards	1,002	C 6
Egremont	43	C 5
Egypt		G 3
El Dorado	50	C 5
Electric Mills	1,200	G 5
Elizabeth	200	C 4
Elliott	250	E 3
Ellisville	3,579	F 7
Embry	300	F 3
Enid	94	E 2
Enondale	61	G 5
Enterprise	691	G 6
Errata	50	F 7
Erwin		B 4
Escatawpa		G 10
Essex	25	D 2
Estabutchie	150	F 8
Estes		F 4
Estesmill	150	F 5
Estill	500	C 4
Ethel	723	F 4
Etta	75	F 2
Eucutta	50	G 7
Eudora	200	D 1
Eupora	1,338	F 3
Eutaw		B 3
Evansville	15	D 1
Fair River		D 7
Falcon	200	D 2
Falkner	600	G 1
Fannin		E 6
Farmhaven	50	E 5
Farrell		C 2
Fayette	1,498	B 7
Fearns Springs		G 4
Fenton	25	F 10
Fentress		F 4
Fernwood	600	D 8
Fitler	300	B 5
Flora	655	D 5
Florence	313	D 6
Foote	100	C 4
Forest	2,874	F 6
Forkville	145	E 6
Fort Adams	105	B 8
Foxworth	750	E 8
French Camp	162	F 4
Friars Point	916	C 2
Fruitland Park	63	F 9
Fulton	1,343	H 2
Gainesville	50	E 10
Gallman	170	D 7
Garlandville	180	F 6
Gatesville		D 6
Gattman	150	H 3
Gautier		G 10
Geneill		C 4
Georgetown	327	D 7
Geren		D 3
Germania		C 5
Gholson	25	G 5
Gibson	275	G 3
Gillsburg	50	C 8
Gitano		F 7
Glancy		C 7
Glen		H 1
Glen Allan	400	B 4
Glendora	178	D 3
Gloster	1,467	B 8
Glover		D 1
Gluckstadt		D 5
Golden	206	H 2
Good Hope	200	E 5
Goodman	878	E 5
Goodyear		E 9
Goshen Springs		E 6
Goss	250	E 8
Grace		C 5
Grand Gulf	25	B 6
Grapeland		B 3
Greenville	29,936	B 4
Greenwood	18,061	D 4
Greenwood Springs	65	H 3
Grenada	7,388	E 3
Gulfport	22,659	F 10
Gunnison	453	C 3
Guntown	299	G 2
Halstead		C 3
Hamburg	100	B 7
Hamilton	100	H 3
Hampton	10	B 4
Handsboro	1,275	F 10
Hankinson	10	C 6
Hardee		C 5
Hardy		E 3
Harperville	125	E 6
Harriston	150	C 7
Harrisville		D 7
Hathorn	350	E 8
Hatley	100	H 3
Hattiesburg	29,474	F 8
Hazlehurst	3,397	D 7
Heads	100	C 4
Heidelberg	863	F 7
Helm	100	C 4
Hermanville	255	C 7
Hernando	1,206	E 1
Hesterville		E 4
Hickory	614	F 6
Hickory Flat	345	F 1
Highlandale	100	D 3
Highpoint	300	F 4
Hillhouse	100	C 2
Hillsboro	190	E 6
Hillsdale		F 9
Hinchcliff	50	D 2
Hintonville	150	F 8
Hinze		F 4
Hiwannee	300	G 7
Hohenlinden	200	F 3
Holcomb	229	D 3
Holcut	300	H 1
Hollandale	2,346	C 4
Holly Bluff		C 5
Holly Ridge	518	C 4
Holly Springs	3,276	E 1
Hollyknowe		C 4
Hollywood	117	D 1
Holmesville	70	D 8
Homewood		E 6
Honey Island		D 4
Hopewell	350	D 7
Horn Lake	1,000	D 1
Houlka	545	G 2
Houston	1,664	G 3
Howard	25	D 4
Howison	75	F 9
Hub	280	E 8
Hudsonville	50	F 1
Hurley		H 9
Hushpuckena	200	C 2
Increase	40	G 6
Independence		E 1
Indianola	4,369	C 4
Ingomar		F 2
Inverness	1,010	C 4
Irene	100	D 8
Isola	450	C 4
Itta Bena	1,725	D 4
Iuka	1,527	H 1
Jacinto	140	H 1
JACKSON	98,271	D 6
James	500	B 4
Jamestown	25	E 8
Jayess	50	D 8
Jeffries		C 2
Johns	800	E 6
Johnstons Station		D 8
Jonestown	741	D 2
Keirn		D 4
Kendrick		H 1
Keownville	15	G 1
Kewanee	200	H 6
Kienstra		B 8
Kilmichael	511	E 4
Kiln		F 10
Kipling		G 5

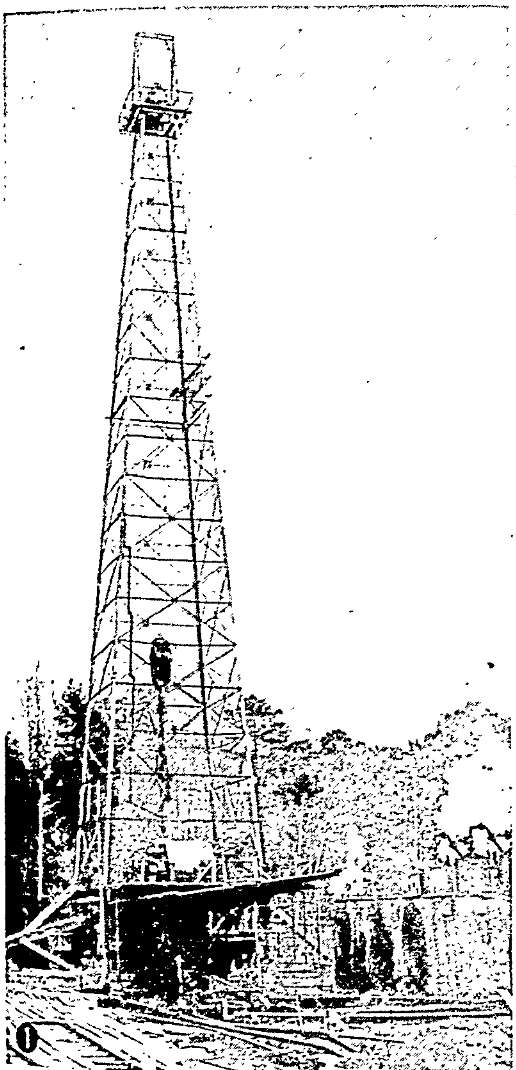


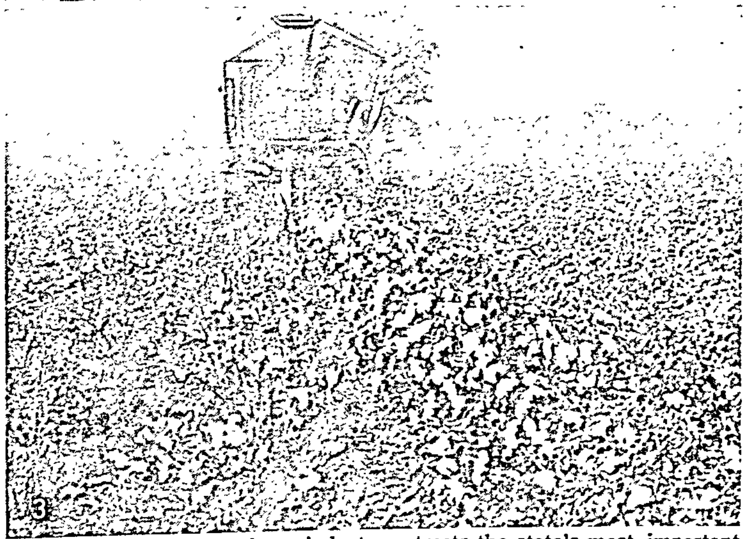
92°
A
30′
B
91°
C
D
90°
E
F
89°
G
H
88°
35°
34°
33°
MEMPHIS
TENNESSEE
MISSISSIPPI
ARKANSAS
ALABAMA
MISSISSIPPI RIVER
Arkansas River
White River
St Francis River
Ouachita
TUNICA
DE SOTO
MARSHALL
BENTON
TIPPAH
ALCORN
TISHOMINGO
PRENTISS
UNION
LEE
ITAWAMBA
TATE
PANOLA
LAFAYETTE
PONTOTOC
COAHOMA
QUITMAN
TALLAHATCHIE
YALOBUSHA
CALHOUN
CHICKASAW
MONROE
BOLIVAR
SUNFLOWER
LEFLORE
GRENADA
WEBSTER
CLAY
LOWNDES
OKTIBBEHA
MONTGOMERY
CARROLL
CHOCTAW
WASHINGTON
HUMPHREYS
HOLMES
ATTALA
WINSTON
NOXUBEE
SHARKEY
YAZOO
Pine Bluff
Stuttgart
Clarendon
Brinkley
Forrest City
Helena
West Helena
Marianna
Greenville
Cleveland
Clarksdale
Greenwood
Grenada
Oxford
Holly Springs
Corinth
Tupelo
Columbus
Starkville
West Point
Aberdeen
Yazoo City
Kosciusko
Louisville
Philadelphia
Macon
Winona
Batesville
Sardis
Senatobia
Water Valley
Charleston
Indianola
Belzoni
Lexington
Durant
New Albany
Ripley
Booneville
Iuka
Okolona
Houston
Pontotoc
Ackerman
Eupora
Lake Village
Monticello
Crossett
Hamburg
Warren
Dermott
Mc Gehee
Bastrop
Lake Providence
Rosedale
Woodall Mtn 806 HIGHEST POINT
SHILOH NAT L MIL PK
PICKW CK LAND NG DAM
Pickwick Lake
ARKABUTLA DAM
SARDIS DAM
Sardis Reservoir
Enid Reservoir
Grenada Reservoir
BRICES CROSS ROADS NATIONAL BATTLEFIELD SITE
TUPELO NATIONAL BATTLEFIELD SITE
ACKIA BATTLEGROUND NAT L MON
COLUMBUS A F B


MISSISSIPPI
SCALE OF MILES
0 5 10 20 30 40
State Capitals
County Seats
Railroads
Copyright by C. S. Hammond & Co., N.Y.
JACKSON
MERIDIAN
Vicksburg
Natchez
Hattiesburg
Laurel
McComb
Brookhaven
Biloxi
Gulfport
Pascagoula
MOBILE
BATON ROUGE
MONROE
Bogalusa
HINDS
RANKIN
SCOTT
NEWTON
LAUDERDALE
SMITH
JASPER
CLARKE
WARREN
CLAIBORNE
COPIAH
SIMPSON
JEFFERSON
JONES
WAYNE
COVINGTON
ADAMS
FRANKLIN
LINCOLN
LAWRENCE
JEFFERSON DAVIS
WILKINSON
AMITE
PIKE
WALTHALL
MARION
LAMAR
FORREST
PERRY
GREENE
GEORGE
STONE
PEARL RIVER
HARRISON
HANCOCK
JACKSON
LOUISIANA
ALABAMA
LAKE PONTCHARTRAIN
MISSISSIPPI SOUND
MISSISSIPPI RIVER
MOBILE BAY
Longitude West of Greenwich
92° 91° 90° 89°
32° 31°

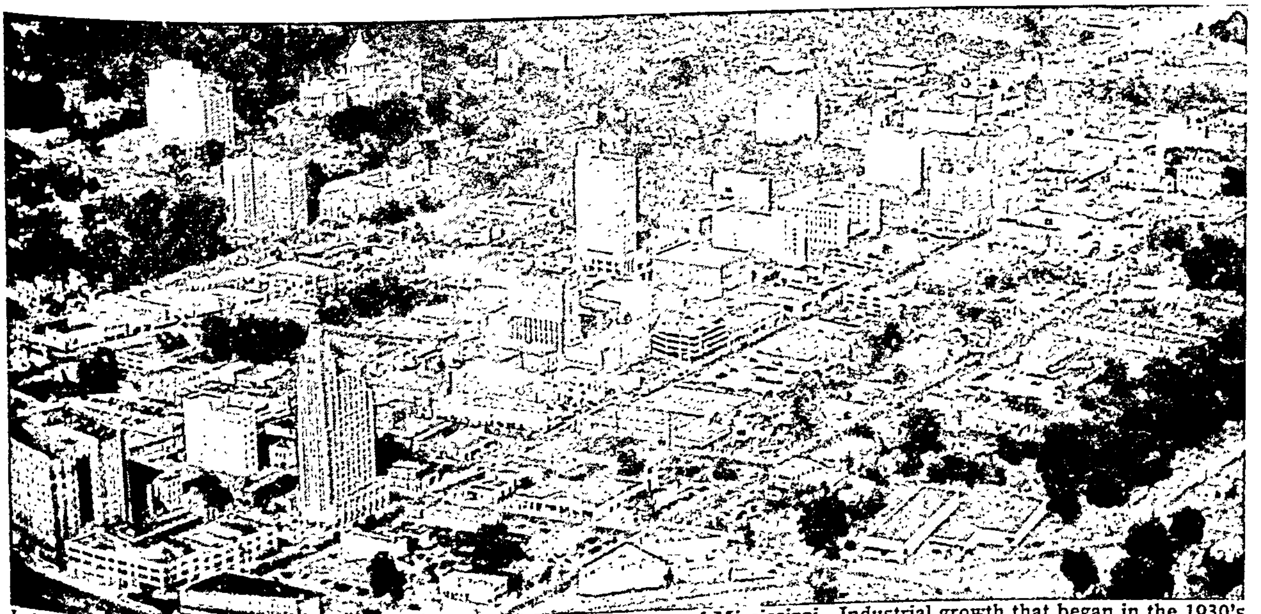
MISSISSIPPI—*Continued*

Kirby	98	C 7
Kirkville	125	H 2
Kittrell	100	G 8
Klein	10	F 6
Knoxville	60	B 8
Kokomo	300	E 8
Kolola Springs	81	H 3
Kosciusko	6,753	E 4
Kossuth	242	G 1
Kreole	1,106	H 10
Lafayette Springs	150	F 2
Lake	345	F 6
Lake Como	150	F 7
Lake Cormorant		D 1
Lake View	100	D 1
Lakeshore	107	F 10
Lamar	70	F 1
Lambert	1,023	D 2
Lamkin	100	D 4
Lamont	250	B 3
Landon	500	F 10
Laneheart		B 8
Langford		E 6
Langsdale	100	G 7
Lauderdale	648	G 5
Laurel	25,038	F 7
Lawrence	300	F 6
Le Flore	75	D 3
Leaf	400	G 8
Leakesville	893	G 8
Learned	126	C 6
Leedo		C 7
Leedy	80	H 1
Leesburg		E 6
Leesdale	20	B 7
Leland	4,736	C 4
Lemon	40	E 6
Lena	353	E 5
Leota Landing	20	B 4
Lessley	40	B 8
Lexie		D 8
Lexington	3,198	D 4
Liberty	683	C 8
Little Rock		F 5
Lobdell	50	B 3
Lockhart	50	G 6
Lodi	50	E 3
Logtown	300	E 10
Lombardy	300	C 3
Long	100	C 4
Long Beach	2,703	F 10
Longtown	82	D 1
Longview	230	G 4
Longwood	65	C 4
Looxahoma	50	E 1
Lorena		F 6
Lorenzen	50	C 5
Lorman	105	B 7
Louin	478	F 6
Louise	479	C 5
Louisville	5,282	G 4
Love	75	D 1
Luce Farms	85	H 9
Lucedale	1,631	G 9
Lucien	100	C 7
Ludlow	500	E 5
Lula	488	C 2
Lumberton	1,803	E 8
Lux		F 8
Lyman	150	F 10
Lynn Creek		G 4
Lyon	386	D 2
Maben	616	F 3
Macel	50	D 3
Macon	2,241	G 4
Madden	350	F 5
Madison	540	D 6
Magee	1,738	E 7
Magnolia	1,984	D 8
Mahned	100	F 8
Malone	25	E 1
Malvina	70	C 3
Mantachie	178	H 2
Mantee	189	F 3
Marietta	125	H 2
Marion	500	G 6
Marks	2,209	D 2
Martinsville		D 7
Marydell	200	F 5
Mashulaville	150	G 4
Matagorda		D 2
Matherville	105	G 7
Mathiston	584	F 3
Mattson	200	C 2
Maud	102	D 1
Maxie	80	F 9
Mayersville	120	B 5
Mayhew	170	G 4
McAdams		E 4
McBride	35	C 7
McCall Creek	300	C 7
McCarley	300	E 3
McComb	10,401	D 8
McCondy	100	G 3
McCool	305	F 4
McCrary	10	H 4
McDonald		F 5
McHenry	400	F 9
McLain	400	G 8
McLaurin	115	F 8
McLeod		H 4
McNair	200	C 7
McNeill	500	E 9
McVille		E 5
Meadville	524	C 8
Mechanicsburg	15	D 5
Meehan	107	G 6
Meltonia		C 3
Mendenhall	1,539	E 7
Meridian	41,893	G 6
Merigold	682	C 3
Merit	25	E 7
Merrill	115	G 9
Mesa		D 8
Metcalfe	100	B 4
Michigan City	38	F 1
Midnight	400	C 4
Mileston	47	D 4
Millard		E 9
Miller	200	E 1
Millville		E 5
Mineral Wells	275	E 1
Minter City	400	D 3
Mississippi City	2,125	F 10
Misterton		E 3
Mize	430	E 7
Money	105	D 3
Monroe	100	C 8
Monticello	1,382	D 7
Montpelier	125	G 3
Montrose	222	F 6
Mooreville		G 2
Moorhead	1,749	C 4
Morgan City	200	D 4
Morgantown	300	E 8
Morton	1,664	E 6
Moscow		G 5
Moselle	500	F 8
Moss	300	F 7
Moss Point	3,782	G 10
Mound Bayou	1,328	C 3
Mount Carmel	50	E 7
Mount Helena		C 5
Mount Olive	827	E 7
Mt. Pleasant	300	E 1
Muldon	60	G 3
Murphy	200	C 4
Myles	50	C 7
Myrleville		D 5
Myrtle	331	F 1
Nanachehaw	19	B 6
Natchez	22,740	B 7
Neely	300	G 8
Nesbit	250	D 1
Neshoba	300	F 5
Nettleton	1,204	G 2
New Albany	3,680	G 2
New Augusta	500	F 8
New Site	24	H 1
Newhebron	303	D 7
Newman	12	C 6
Newton	2,912	F 6
Nicholson	500	E 10
Nitta Yuma	90	C 4
Nod	20	D 5
Nola	120	D 7
Norfield	123	C 8
Norris		F 6
Northcarrollton	506	E 3
Noxapater	615	F 5
Nugent		F 10
Oak Ridge	200	C 6
Oak Vale	136	E 8
Oakland	551	E 2
Oakley	205	D 6
Ocean Sprs.	3,058	G 10
Ofahoma	50	E 5
Okolona	2,167	G 2
Oldenburg		C 7
Olive Branch	534	E 1
Oloh	50	E 8
Oma	50	D 7
Onward		C 5
Ora		E 7
Orange Grove	150	H 10
Orvisburg		E 9
Osborn	120	G 3
Osyka	724	D 8
Ovett	357	F 8
Owens Wells		E 4
Oxford	3,956	F 2
Pace	422	C 3
Pachuta	273	G 6
Paden	158	H 1
Palmers Crossing		F 8
Panther Burn	30	C 4
Parchman		D 3
Paris	84	F 2
Pascagoula	10,805	G 10
Pass Christian	3,383	F 10
Pattison	300	C 7
Paulding	400	F 6
Paulette	126	H 4
Paynes	125	D 3
Pearlington	150	E 10
Pearson		D 6
Pecan	100	H 10
Pelahatchie	867	E 6
Penton	100	D 1
Peoria		C 8
Percy		C 4
Perkinston	400	F 9
Perthshire		C 3
Petal	2,148	F 8
Peyton	25	C 7
Pheba		G 3
Philadelphia	4,472	F 5
Philipp	350	D 3
Phoenix		C 5
Piave		G 8
Picayune	6,707	E 9
Pickens	638	E 5
Pinckneyville		B 8
Pine Ridge		B 7
Pine Valley	75	E 2
Pineville		F 6
Piney Woods	750	D 6
Pinola	143	E 7
Pittsboro	246	F 3
Plain	500	D 6
Plantersville	479	G 2
Plattsburg		F 5
Pleasant Grove		D 2
Pleasant Hill	200	E 1
Plumpoint		E 1
Pocahontas	500	D 6
Polkville	150	E 6
Pond		B 8
Pontotoc	1,596	G 2
Pope	246	E 2
Poplar Creek	350	E 4
Poplarville	1,852	E 9
Port Gibson	2,920	B 7
Porterville	88	G 5
Potts Camp	432	F 1
Powell	80	D 2
Prairie	654	G 3
Prairie Point		H 4
Prentiss	1,212	E 7
Preston	375	G 5
Pricedale	300	D 8
Prichard		D 1
Priscilla	75	C 3
Puckett	300	E 6
Pulaski	1,000	E 6
Purvis	1,270	F 8
Pyland	125	F 3
Quentin	300	C 8
Quincy		H 3
Quitman	1,817	G 6
Raleigh	580	F 6
Randolph	243	F 2
Rara Avis		H 2
Ratliff	60	H 2
Ravine		H 4
Raymond	1,259	D 6
Red Banks	450	F 1
Red Lick		B 7
Redwood		C 6
Reform	400	F 4
Rena Lara	50	C 2
Renfro		F 5
Renova	250	C 3
Riceville	40	F 9
Rich	61	D 2
Richey	86	C 4
Richton	1,158	G 8
Ridgeland	526	D 6
Rienzi	468	G 1
Rio		G 5
Ripley	2,383	G 1
Roberts		F 6
Robinsonville	100	D 1
Rockport		D 7
Rodney	209	B 7
Rolling Fork	1,229	C 5
Rome	189	C 3
Rose Hill	500	F 6
Rosedale	2,197	B 3
Rosetta		B 8
Roundaway	150	C 2
Roundlake	230	C 2
Rounsaville	19	G 8
Roxie	521	B 7
Rudyard	110	C 2
Ruleville	1,521	C 3
Runnelstown		F 8
Rural Hill	3	F 4
Russell	275	G 6
Russum	350	B 7
Ruth		D 8
Sabougla	100	F 3
Sallis	228	E 4
Saltillo	501	G 2
Sanatorium		E 7
Sandersville	681	F 7
Sandhill		E 5
Sandy Hook		E 8
Sanford		F 8
Sapa		F 3
Sarah	93	D 1
Saratoga	65	E 7
Sardis	1,913	E 2
Sarepta	90	F 2
Satartia	105	C 5
Saucier		F 9
Savage		D 1
Schlater	300	D 3
Scobey	112	E 3
Scooba	734	G 5
Scott	2,000	B 3
Sebastopol	330	F 5
Selma	2	B 7
Seminary	345	E 7
Senatobia	2,108	E 1
Seneca	12	F 8
Sessums		G 4
Shannon	520	G 2
Sharon		E 5
Shaw	1,892	C 3
Shelby	2,148	C 3
Sherard	75	C 2
Sherman	386	G 2
Shipman	7	G 9
Shivers	100	E 7
Shoccoe		E 5
Shubuta	782	G 7
Shuqualak	714	G 5
Sibley	25	B 8
Sidon	361	D 4
Signal	360	C 6
Silver City	381	C 4
Silver Creek	275	D 7
Skene	250	C 3
Slate Spring	134	F 3
Slayden	45	F 1
Sledge	383	D 2
Smedes		C 5
Smithdale	100	C 8
Smiths		C 6
Smithville	419	H 2
Soegaard		D 7
Sontag		D 7
Soso	171	F 7
Spanish Fort	120	C 5
Springville	400	F 2
Stafford Sprs.	200	F 7
Stallo	500	F 5
Stampley	23	B 7
Stanton		B 7
Star	300	D 6
Starkville	7,107	G 4
State College	4,000	G 4
State Line	492	G 8
Steel		F 6
Steens	95	H 3
Stewart	311	F 4
Stokes		D 5
Stoneville		C 4
Stonewall	1,015	G 6
Stovall		C 2
Stover	120	D 2
Stratton		F 6
Strayhorn	125	D 1
Street	50	C 8
Stringer	150	F 7
Stringtown	500	C 3
Strong	500	G 3
Sturgis	402	G 4
Sucarnochee		H 5
Summerland	112	F 7
Summit	1,558	D 8
Sumner	550	D 3
Sumrall	853	E 8
Sun		F 6
Sunflower	639	C 3
Swan Lake	50	D 3
Sweatman		E 3
Swiftown		D 4
Swiftwater	10	B 4
Sylvarena	112	F 6
Symonds		C 3
Tallula		B 5
Tamola	55	G 5
Taylor	125	E 2
Taylorsville	1,116	F 7
Tchula	927	D 4
Terry	497	D 6
Thaxton	300	F 2
Theadville	75	G 7
Thomastown	250	E 5
Thomasville	25	E 6
Thorn	60	F 3
Thornton	50	D 4
Thrasher	200	G 1
Thyatira		E 1
Tibbee Station	35	G 3
Tie Plant	400	E 3
Tilden	150	H 2
Tillatoba	127	E 3
Tillman	150	C 7
Tiplersville	110	G 1
Tippo	80	D 3
Tishomingo	335	H 1
Toccopola	262	F 2
Tomnolen	150	F 4
Toomsuba	500	G 6
Topton	15	G 6
Tougaloo		D 6
Tralake	250	C 4
Traxler	75	E 6
Trebloc	300	G 3
Tremont		H 2
Trenton		E 6
Tribbett	100	C 4
Troy		G 2
Tula	150	F 2
Tunica	1,354	D 1
Tupelo	11,527	G 2
Turnbull		B 8
Tuscola	250	E 5
Tutwiler	939	D 2
Tylertown	1,331	D 8
Tyro	750	E 1
Union	1,559	F 5
Union Church	275	C 7
University	1,200	E 2
Utica	824	C 6
Utica Institute		C 6
Vaiden	583	E 4
Valley	125	D 5
Valley Park		C 5
Value	300	D 6
Van Vleet	300	G 3
Vance		D 2
Vancleave		G 9
Vardaman	686	F 3
Vaughan	350	D 5
Velma		E 2
Verba		F 6
Verna	12	D 8
Vernal		G 8
Verona	589	G 2
Vicksburg	27,948	C 6
Victoria		E 1
Vidalia	25	F 10
Vimville		H 6
Vossburg	500	F 7
Wade	300	G 9
Wahalak		G 5
Waldrup		F 7
Wallerville	100	G 2
Wallfield		F 2
Walls	318	D 1
Walnut	481	G 1
Walnut Grove	517	F 5
Waltersville	250	C 6
Walthall	149	F 3
Wanilla		D 7
Washington		B 7
Water Valley	3,113	E 2
Waterford	125	E 1
Waveland	793	F 10
Waxhaw		C 3
Way		E 5
Waynesboro	3,442	G 7
Wayside		C 4
Weathersby	145	E 7
Webb	680	D 3
Weir	570	F 4
Wenasoga	150	G 1
Wesson	1,235	D 7
West	354	E 4
West Enterprise		G 6
West Point	6,432	G 3
Whaley	15	D 3
Wheeler	300	G 1
White Apple	25	B 8
White Bluff	25	E 8
Whiteoak	50	E 6
Whitfield		E 6
Whitfield	40	D 3
Whynot	60	G 6
Wicker		E 6
Wiggins	1,436	F 9
Wilkinson	300	B 8
Williamsville		F 4
Willows	30	C 6
Winborn		F 1
Winchester		G 7
Wingate	150	G 8
Winona	3,441	E 4
Winstonville	322	C 3
Winterville		B 4
Woodland	133	F 3
Woodville	1,609	B 8
Wren	250	G 3
Wyatte	100	E 1
Yazoo City	9,746	D 5
Yokena	25	C 6
Youngs	25	E 3
Zama		F 5
Zion Hill	50	C 8





Much of the income of Mississippi comes from the land. 1. The growing petroleum industry extracts the state's most important mineral. 2. A reforestation program, abundant moisture, and a long growing season make the state a leader in lumber production. 3. Mechanical cotton pickers are replacing hand pickers in the delta region and help to keep cotton output at a high level and production costs low. In cotton production Mississippi usually ranks second only to Texas.



Jackson, the state's capital and largest city, is the manufacturing center of Mississippi. Industrial growth that began in the 1930's was rapid after the second World War. Mississippi is still largely agricultural but now it has a more balanced economy. Climate, markets, and supplies of materials, power, and labor attract industries.

MISSISSIPPI'S CAPITOL AT JACKSON

The State Capitol, completed in 1903, stands on a high terrace. It is built of gray Indiana stone in the French Renaissance style and cost about $1,000,000. Atop the dome is an 8-foot gold-leaf covered eagle with a 15-foot wingspread.

Historic Vicksburg and Natchez are the state's major river ports. They are noted for their cotton trade. Hattiesburg's chief products are naval stores and men's clothing. The coast towns, such as Biloxi, Gulfport, Pass Christian, and Ocean Springs are noted as winter resorts. The University of Mississippi, opened in 1848, is at University, near Oxford. At State College is Mississippi State College, founded in 1878.

Four Centuries of History

The first European to enter the present state of Mississippi was the Spanish explorer Hernando De Soto. He came in 1540. René Robert Cavelier, Sieur de La Salle claimed the country in the name of France in 1682; and the French established a fort near Biloxi in 1699 and another at Natchez in 1716. Part of the territory was ceded to Great Britain in 1763. Spanish troops occupied the region in 1781. At the close of the American Revolution, Spain evacuated part of the area and ceded the remainder to the United States in 1795. Mississippi became a territory in 1798 and a state in 1817.

Early development was keyed to river transportation. From the Gulf coast, settlers made their way up the Mississippi, Pearl, and Pascagoula rivers to establish new homes. Other settlers came down the Mississippi River. Towns were built on the river banks where the products of surrounding farms could be loaded onto flatboats and sent to markets on the coast. After 1811, when the first Mississippi River steamboat *New Orleans* was built, steamers rapidly replaced the raftlike flatboats and keelboats (*see* Mississippi River). The first wagon roads, such as the Natchez Trace, were developed in close connection with river routes (*see* Roads).

In the 1830's railroad construction was begun to connect inland areas with river ports. As the railroads were improved and extended, they became rivals of the rivers. Now Mississippi has about 3,700 miles of railroads and about 62,000 miles of rural roads.

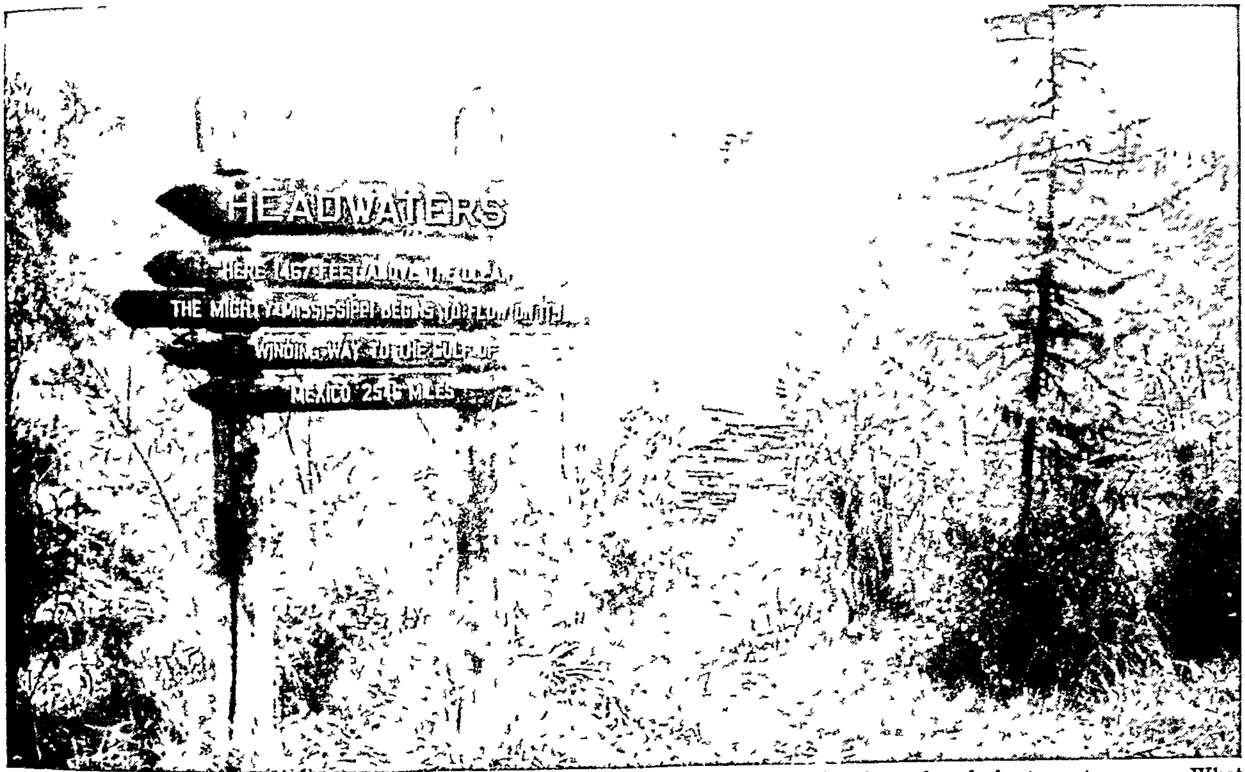
During the Civil War much of the state was devastated (*see* Vicksburg, Battle of). For years recovery was retarded by the events of political reconstruction. After 1875 Mississippi's development was keyed to cotton and lumber. Then in the 1930's the state's economy was altered by crop diversification and the addition of new manufactures.

In 1927 the Mississippi River swept over levees in the delta area causing damage of about 40 million dollars. To control floods, the United States Army engineers strengthened levees, dug cutoffs, and built reservoirs. (*See also* chronology in Mississippi Fact Summary; United States, section "The South.")

UNIVERSITY OF MISSISSIPPI AT UNIVERSITY

Among wooded hills in northern Mississippi near Oxford is the state university. Pride of the school is the white-columned Lyceum, more than 100 years old. It was the first classroom building when the university opened in 1848.

The MIGHTY "FATHER *of* WATERS"



The birthplace of the Mississippi River is Lake Itasca in northwestern Minnesota. On its way to the Gulf of Mexico the river continually changes its channel and shortens its course. What was once 2,546 miles is now 2,351 to the Head of Passes.

MISSISSIPPI RIVER. The "Father of Waters," the Mississippi River, is one of the longest in the world. If it is measured from the headwaters of its longest branch, the Missouri, it flows 3,872 miles to the Head of Passes in the delta. (The "passes," which empty into the Gulf of Mexico and old meanders, now cut off, once made the length about 4,200 miles.) The drainage basin extends from western Pennsylvania to Idaho, embraces two fifths of the United States, and is second in size only to the valley of the mighty Amazon. The greater part of this vast region is enormously fertile, which makes the Mississippi Valley an agricultural empire second to none. More than 50 million people live in the states drained by this mighty river, which comprises an area equal to half of Europe.

Early Spanish explorers in the Gulf of Mexico had noted the mouth of this great river and named it the "River of the Holy Ghost." Hernando de Soto is usually considered its discoverer. He not only encountered the wide muddy stream in his explorations in 1541, but died upon its banks and was buried in it. The rest of his party floated down the great river to the Gulf of Mexico to escape hostile Indians. More than a hundred years passed before other white men saw it. Then in 1673 the brave and determined Frenchmen, Marquette and Joliet, descended it as far as the mouth of the Arkansas River. It remained for La Salle and his party, in 1682, to follow the river to the gulf. Starting from the headwaters of the Illinois River, they boldly pushed their way past the mouths of the Missouri and the Ohio, down the great bends lined on either side with dense forests, through the marshy delta, with its three branches, until they reached the gulf—"lonely as when born of chaos, without a sail, without a sign of life." Two years earlier Hennepin, sent by La Salle, had explored the upper river from the mouth of the Illinois to the Falls of St. Anthony, where Minneapolis now stands. A hundred and fifty years later, in 1832, Henry Schoolcraft followed the Mississippi proper to its source in several small Minnesota lakes, including Lake Itasca.

As it issues from the cool clear waters of Lake Itasca, the Mississippi is only a little stream, 10 or 12 feet wide, and about two feet deep. For a time it rushes north, over rapids and around boulders, with reeds, flags, and watergrass growing profusely on its banks and in its crystal waters. After much twisting and turning, it settles into its southeasterly flow. Tributaries join it, often as large as the river itself, until it reaches a width of 1,200 feet at the Falls of St. Anthony. Here the river descends about 65 feet in three-quarters of a mile, forming rapids, in the midst of which rears a precipice 18 feet high. Over this the river once plunged in a beautiful cataract. Now this water power has been used to build up the manufacturing interests of Minneapolis.

Southward the banks of the stream rise in rocky bluffs, sometimes as high as 500 feet, and continue almost to the junction of the Ohio River. The distance between the two lines of bluffs varies from

three to eight miles, and the river wanders back and forth between them sometimes touching one side, sometimes the other. Along most of the way the centuries have built up gentle slopes at the foot of these bluffs, covered with trees and grass to the water's edge; but here and there the cliffs rise straight up from the water in great towering palisades of rugged beauty. Where the Chippewa River flows into the Mississippi, 77 miles below St. Paul, the river spreads out over the entire valley, forming beautiful Lake Pepin, 25 miles long and two to three miles wide.

The Ancient Mississippi and the Vanished Sea

At Cape Girardeau, 52 miles above the mouth of the Ohio, the bluffs cease and the great alluvial valley, which the river has built, begins. Long ago an ancient gulf extended up as far as the lower edge of the bluffs. The Mississippi poured its silt into this gulf, gradually filling it and building a vast fertile valley four times as large as that of the Nile. In the past 200 years, the river has extended the land area only a few miles, so the task of building this huge valley must have required long ages.

In the lower bottomlands of the Mississippi the elevation of the surrounding country is usually lower than that of the river banks. Through the ages the river has built these high banks, or "natural levees," in times of flood, by repeatedly depositing coarse materials along the edges of the stream as its velocity slackened. The present lower river thus flows between broad ridges five to ten feet higher than the adjacent lowlands.

A common idea that the Mississippi has elevated its bed by depositing sediment on its bottom has been termed a misconception by engineers. They say the river is a "poised" stream, neither building nor scouring its channel, except at bends and crossings.

Alluvial bottoms do not fill all the space between the mouth of the Ohio and the gulf. On the east bank rise high spots, which were capes and peninsulas on the ancient ocean. Towns have been built on many of them—at Columbus, Ky., Randolph and Memphis, Tenn., Vicksburg and Natchez, Miss., and Baton Rouge, La.

The Mississippi enters the Gulf of Mexico through the delta—a marshy impassable area of more than 12,000 square miles. Here the main river divides and flows through four great arms, or passes, known as Cubits Gap, Pass A'Loutre, South Pass, and South West Pass.

Vast Drainage Basin of the Mississippi

The character of the Mississippi as a clear, placid northern river does not change until the great Missouri pours its red-mud torrent into it just above St. Louis. In high water this stream has a volume greater than that of the Upper Mississippi, and for miles the waters of the two rivers may flow side by side without mixing. A little farther on the Ohio brings down from the Alleghenies a volume of water normally greater than the other two combined.

In the Mississippi system there are 250 tributaries and their branches, making about 12,000 miles of navigable waters. The system's drainage basin includes all or parts of 31 states and two Canadian provinces, covering some 1,250,000 square miles.

The Mississippi varies greatly in width. At the mouth of the Illinois it is about 1,400 feet wide. Below the mouth of the Missouri it widens to 7,000 feet but narrows again to about 3,000 feet in the lower valley. At New Orleans its depth varies from 30 feet in winter to a flood depth of 62 feet. Its narrower upper stretches are crossed by many bridges. Below St. Louis 11 span it, including the great 4.4-mile railway and highway bridge above New Orleans.

More than 750 islands large enough to be named or numbered dot the river from St. Paul to its southernmost tributary, the Red River. Around these the Mississippi twists and winds. In one stretch it flows 1,300 miles to cover a straight-line distance of 675 miles. It has a tendency to meander and build out long necks of land around which it flows. Then it erodes the banks on the concave side of the bends. Finally the river breaks through the narrow neck of land and forms a cutoff. The old channel remains as a crescent "ox-bow" lake, also called a bayou (*see* Lakes; Rivers).

Annual Floods and their Control

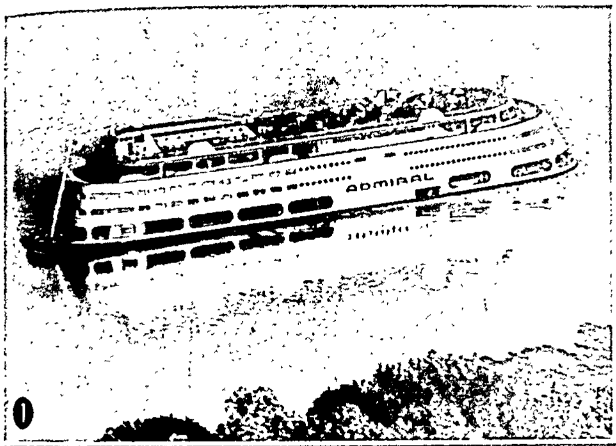
In the spring heavy rains along the river and its tributaries, combined with melting snows in the mountains, raise the water level. The basin soaks up some of the water. After its soil becomes saturated the water rushes down the tributaries to the main stream and floods occur, bringing destruction and tragedy.

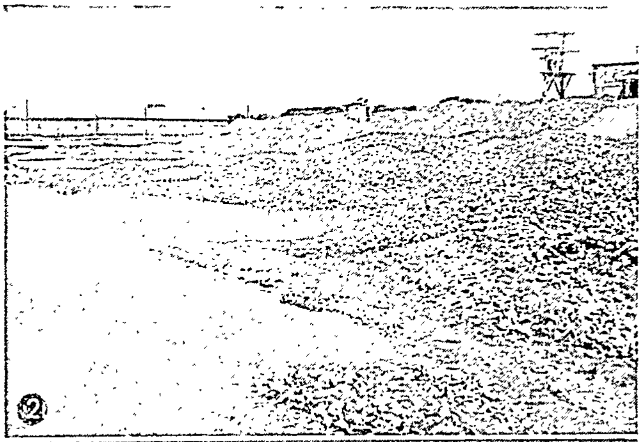
New Orleans protected itself from flood more than two centuries ago with a dirt embankment a few feet high, called a *levee*. The next flood broke through. Since then, higher, stronger, and longer levees have been built along the lower river, but each major flood broke through some of them. In 1927 the river's worst flood broke through in a dozen places, flooded an area the size of South Carolina, took 200 lives, drove 700,000 people from their homes, and destroyed property worth 275 million dollars.

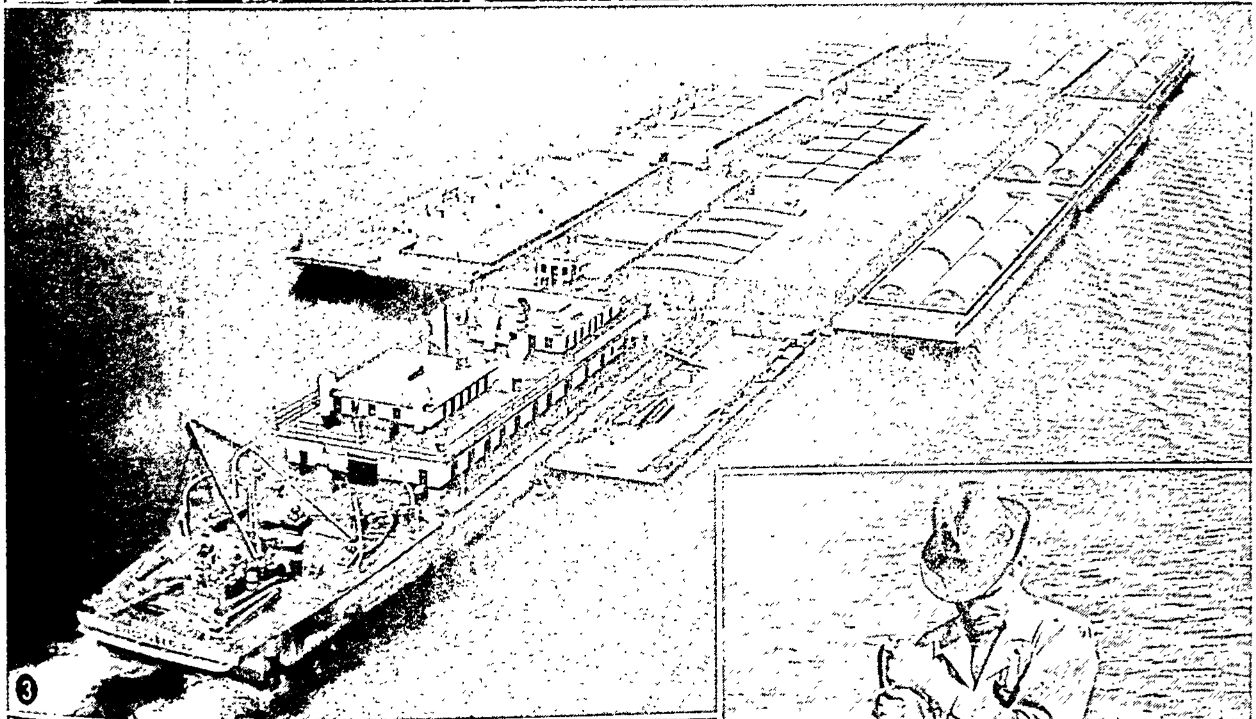
After this disastrous flood, Congress provided for a broad program of flood control. The Mississippi River Commission, Corps of Engineers, United States Army, has charge of federal activities. Flood control works include cutoffs, levees, revetments, spillways, and reservoirs. The total cost has been enormous, yet it has been essential to save life and property.

Because a chain of levees is only as strong as its weakest link, levees of uniform strength and capacity have been constructed from Cairo, Ill., to the gulf. Built of earth and 21 feet in average height, the new levees are surfaced with Bermuda grass. In the 21 years from 1928 to 1949 some 982 million cubic yards of earth were placed in levee structures.

Revetments protect them against caving. Though willow and lumber mats, riprap, and concrete blocks have been used, articulated concrete mattresses have been found most effective. A flexible mat is made of concrete slabs connected by fabric and cable. It extends from above the water's edge past the deepest part of the channel.







1. This new style Mississippi steamboat is streamlined but still flat bottomed like 19th-century river craft. 2. Here is a pile of river clamshells. Buttons have been cut from them and the remains will be ground up for poultry feed. 3. Oil and coal move along the river in barges. 4. This air view shows the head of the passes through which the river enters the gulf. South and South West passes (center and right) are maintained at depths of 30 to 35 feet for navigation. 5. Mississippi catfish grow large.

Spillways and cutoffs provide outlets through which flood waters can flow safely to the gulf. By reducing the height of water in the main channel they relieve pressure on the levees. One spillway system, composed of three floodways, is in the Atchafalaya River basin in western Louisiana. The Bonnet Carré Spillway enters Lake Pontchartrain above New Orleans. Fifteen artificial cutoffs and one natural cutoff between Memphis and the mouth of the Red River have shortened the river 152 miles and lowered flood stages 12 feet in places. Many tributaries of the Mississippi have been dammed to make storage lakes and reservoirs. They hold excess water in flood time and permit its release in dry seasons to help maintain the depth of water needed for navigation.

Another flood control measure is the restoration of the natural cover of forest and grass on land which has been laid bare by lumbering or on farms which are no longer productive. The natural vegetation and its roots act as a sponge to hold water from melted snow and heavy rains and to release it gradually through the year. (*See also* Floods.)

Erosion, Land Building, and Land Enrichment

Every year, and especially during the spring, the runoff of the water from the land carries away a tremendous tonnage of topsoil. Much of this material is carried as silt down the Mississippi and is deposited at the mouth. This helps to build a *delta* of new land outward into the Gulf of Mexico.

On the average, the Mississippi dumps into the ocean some 400 million tons of soil a year—enough to cover 3,240 square miles with a layer of silt one inch thick. This process started many ages ago when the river emptied into a long bay or arm of the ocean near Cairo, Ill. Today it has filled this bay to beyond New Orleans, and the alluvial or river-borne soil beneath that city is at least 700 feet thick.

Before man interfered, this constant transfer of soil from the uplands to the ocean was reduced somewhat by the annual floods. These deposited a thin layer of silt on the lands along the river's lower course and renewed their fertility. The Nile has kept Egypt fertile in this way for thousands of years. Along the Mississippi today the levees prevent this by delivering the flood waters to the sea.

This loss could be prevented by allowing the river to flood certain areas every year. But the cost would be tremendous. Communities would have to be built narrowly as "string towns" along the tops of levees and other high land. Farmers would have to live in town and travel to their farms, while all buildings needed on the farms would have to be high enough or strong enough to withstand damage from flood waters.

Early Boating on the River

From the earliest days until railroads were built in the western United States, the Mississippi and its branches carried most of the traffic through the vast river basin. At first the commerce was carried in flatboats ("broadhorns" and barges) and in keel boats. These craft carried pork, corn, flour, whiskey, hides, and staves to New Orleans. There the boats were sold for lumber or reloaded with manufactured goods and poled or warped back upstream. The round trip often took nine months. (*See also* Pioneer Life.)

In 1811, four years after Fulton built the first successful steamboat, Nicholas Roosevelt built the steamboat *New Orleans* at Pittsburgh and took it down the Ohio and Mississippi, reaching New Orleans in January 1812. Since the steamer could not operate against heavy currents, it was put on the Natchez-New Orleans run. In 1815 Henry Shreve sailed upstream with a shallow-draft boat, the *Enterprise.* Next year he built an improved vessel, the *Washington,* and took it from Pittsburgh to New Orleans, then back to Louisville. The *Washington* met all needs because it carried powerful, high-pressure boilers and engines on the deck of a shallow, barge-like hull. Thus it drew only a few feet of water, and strong currents caused only a slight drag to offset its power.

The Golden Days of River Traffic

Within a few years, vessels of this type swarmed on the Mississippi River and its tributaries. In January 1834, 230 steamboats and 4,000 flatboats were listed on the Mississippi alone. Transportation of coal on the Ohio, starting in the 1840's, became a great business. In 1853 St. Louis had 3,307 visits from steamboats, exclusive of the daily Alton packet.

The cargoes included skins and lumber from the North, grain and meat from the central region, and coal from the Ohio. The South sent cotton, sugar, molasses, and miscellaneous freight. Along the banks cities grew rapidly, among them Minneapolis, St. Paul, Winona, Dubuque, Davenport, Rock Island, Burlington, Keokuk, Quincy, St. Louis, Cairo, Memphis, Baton Rouge, and New Orleans. The life of a steamboat man in those days was romantic and frequently beset with perils, as many boats were lost. Mark Twain spent part of his life as a pilot on the river during these great days and has written of it in his interesting book 'Life on the Mississippi.'

Decline and Revival of River Traffic

After the 1860's this prosperous period ended. The trend of settlement set strongly westward, and this took traffic from the north–south line of the Mississippi. Transcontinental railroads were built; and railroad efficiency, with its ability to serve industry far from any river bank, completed the ruin of Mississippi River steamboating.

During the first World War, the pendulum began to swing back. The railroads were unable to handle the enormously increased volume of traffic, and the government decided to build fleets of barges and towboats to meet the emergency. After the war the new service was placed in the hands of a government-controlled Inland Waterways Corporation. In order to provide a nine-foot depth of water in the Mississippi above the mouth of the Missouri, the government added a series of 24 dams and locks to supplement two older ones at Keokuk and Minneapolis. They were completed in 1940. These measures revived traffic, and even in 1931, before the dams were completed, the Mississippi was carrying the greatest tonnage in its history.

MISSOURI'S FARMS, FACTORIES, *and* MINES

A Picturesque Valley among the Wooded Slopes of the Ozarks in Southern Missouri

MISSOURI. If any state of the Union can be called "central," that state is Missouri. It is about halfway between the Atlantic Ocean and the Rocky Mountains, and midway between Canada and the Gulf of Mexico It extends farther south than Virginia, and yet also reaches farther north than Kansas or Kentucky. Throughout Missouri's history this central position among the states has greatly influenced the social and economic life of its people.

Missouri is especially favored by two great rivers, the Mississippi and Missouri. The Mississippi forms all the eastern border except for the extreme northeast and a tiny neck of land in the southeast. It separates Missouri from Illinois, Kentucky, and Tennessee. The Missouri River forms the northern part of the western boundary, then turns east at Kansas City and flows through the heart of the state. It joins the Mississippi about ten miles above St. Louis. These two rivers and their tributaries make Missouri one of the leading states in number of miles of navigable waterways.

A State of Prairies and Mountains

The landscape is widely varied. In the north and west are rolling prairies of rich alluvial soil. To the south are the rough densely forested slopes of the Ozark Mountains. This roughness extends into southern Illinois, Oklahoma, and northern Arkansas.

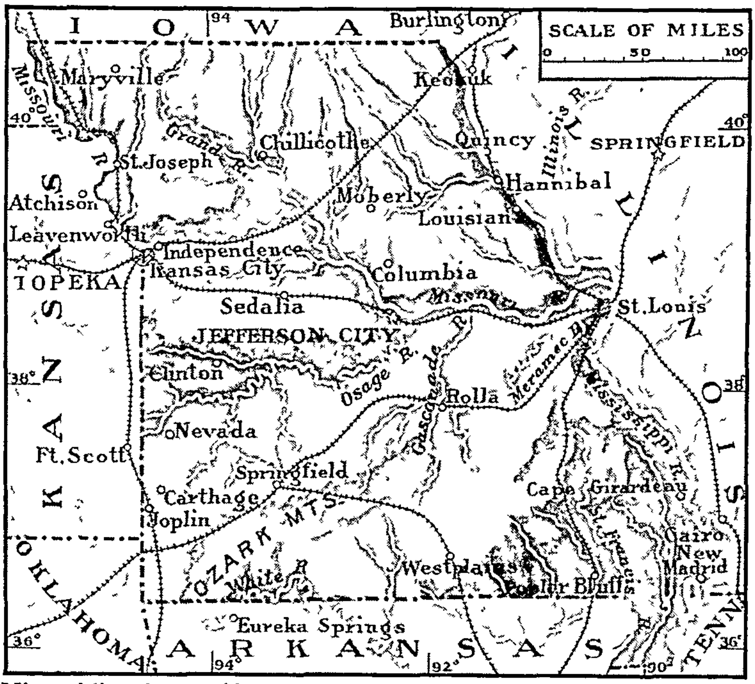
The Ozark Mountains are really the eroded remnants of a former plateau, into which many valleys have been cut by streams. The crests in Missouri range up to about 1,800 feet above sea level. These hills afford some of the most beautiful scenery of the Mississippi basin. Between great rock cliffs are deep narrow valleys, where lie clear rapid streams and wonderful springs. A number of great caves, many miles long, like the one described in 'Tom Sawyer', contain hidden streams and great halls and galleries adorned with stalactites There are also numerous groups of mineral springs. These, together with the attractive scenery and healthful climate, make some places in and near the Ozark region popular health resorts. Among the well-known mineral watering places are Excelsior Springs near Kansas City and Sweet Springs near Sedalia.

The fertile, black lowlands of the southeastern corner of the state are a part of the Gulf Coastal Plain. The lowest portions of this region are swampy, but much of it has been cleared and drained to provide a rich farming area. Miles of levees along the Mississippi protect the bottomlands from floods.

Missouri Has a Continental Climate

The climate varies between rather wide extremes, since the state lies in the center of the continent far from the oceans. While the Ozarks temper agreeably

AT THE CROSSROADS OF THE NATION



Missouri lies almost midway between the North and South and the East and West. The state is drained by the Mississippi River and its tributaries, chiefly the Missouri and the branches of the White River in Arkansas.

the summers in the southwest, they do not affect the climate of the state as a whole. The winters are generally mild, but the temperature sometimes falls below zero, and about once in every four or five years the Mississippi River freezes, partly as a result of floating ice from the north. The Missouri River is often covered with ice during the winter months. Summers are generally moderate except in the extreme southeast, which frequently experiences short periods of almost tropical heat. Rainfall is usually abundant, varying from about 32 inches a year in the northwest to about 50 inches in the southeast.

Wealth from the Soil

Missouri, lying in the heart of the fertile Mississippi basin, is chiefly an agricultural state. About one third of its area is devoted to crops; and fertile soil enables Missouri to rank among the leading states in the value of its agricultural products.

Corn is the most important crop. Other valuable farm products are hay, cotton lint, wheat, oats, soybeans, and cottonseed. Apples and peaches grow in all parts of the state. Missouri also produces many kinds of fruit that cannot be grown successfully farther north, such as apricots and several varieties of grapes. In the southern part of the state, cotton and tobacco are important crops. Also valuable are milk, eggs, and chickens.

Missouri is also a leading state in the raising of livestock. Income from the sale of animals and animal products usually exceeds that received for crops. The raising of cattle and hogs is an important industry in the central region. The southern counties are dotted with many large sheep farms. The state has long been famous for its fine mules and blooded horses.

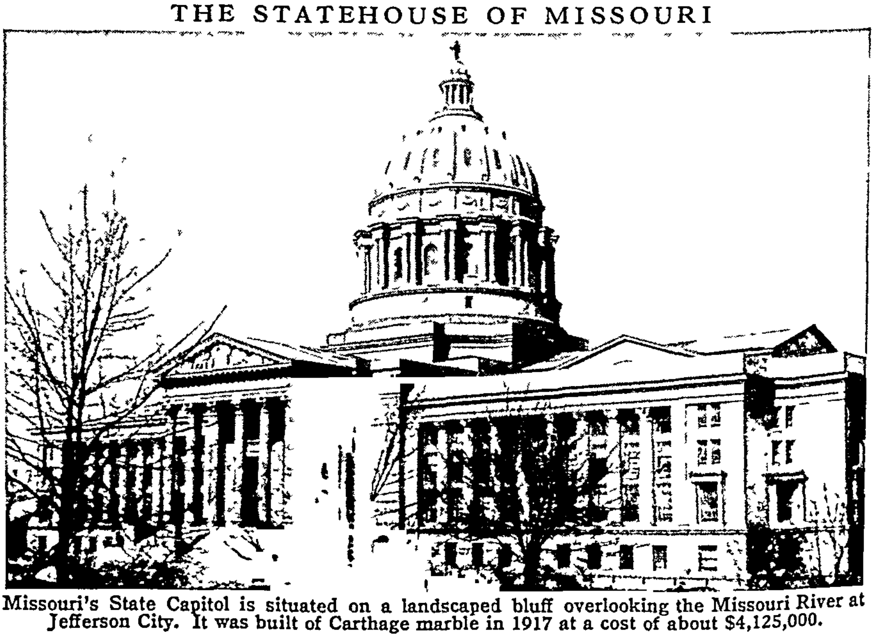
More than one third of the land is covered with forests. Particularly valuable are the hardwoods of the Ozarks. Missouri is one of the few Middle Western states that still market railroad ties, lumber, laths, and shingles.

Missouri's Mines and Manufactures

Missouri leads all other states as a source of lead. The chief district, in the southeast, has been producing lead ores since 1723. Another valuable mineral of the state, coal, is mined in almost one third of the counties. Most of the supply of coal in the state is taken from the ground by strip-mining methods.

Missouri has quarries producing important quantities of cement, stone, lime, sand and gravel, and several varieties of clay. Carthage marble is known for its hardness, durability, and appearance. Zinc is mined in the southwest. Iron ores are distributed throughout the Ozark region, but ore veins are diffi-

THE STATEHOUSE OF MISSOURI



Missouri's State Capitol is situated on a landscaped bluff overlooking the Missouri River at Jefferson City. It was built of Carthage marble in 1917 at a cost of about $4,125,000.

Continued on page 323

Missouri Fact Summary

MISSOURI (Mo.): Probably from Algonquian Indian word meaning "town of the great canoes."

Nickname: "Show Me State," coming from speech of Willard D. Vandiver in Philadelphia in 1899. He said, ". . . I'm from Missouri, and you've got to show me." Also "Ozark State."

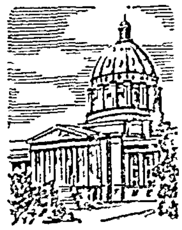
Seal: Two bears support circular shield showing a bear, a crescent, and the arms of the United States; above shield, a cloud and 24 stars. Motto below shield.

Motto: Salus Populi Suprema Lex Esto (Let the Welfare of the People Be the Supreme Law).

Flag: For description and illustration, *see* Flags.

Flower: Hawthorn. **Bird:** Bluebird. **Tree:** None official. **Song:** 'Missouri Waltz'—words, J. R. Shannon; music, Don Valentine Eppel.

THE GOVERNMENT



Capital: Jefferson City (since 1826).

Representation in Congress: Senate, 2; House of Representatives, 11. Electoral votes, 13.

General Assembly: Senators, 34; term, 4 yrs. Representatives, 157; term, 2 yrs. Convenes 1st Wednesday after January 1 in odd-numbered years. Regular and special sessions are limited to 120 days.

Constitution: Adopted 1945. Proposed amendment must be (a) passed by majority vote of both legislative houses, or by initiative action of the people, and (b) ratified by a majority voting on amendment.

Governor: Term, 4 years. May not succeed himself.

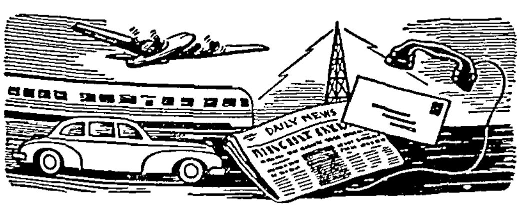
Other Executive Officers: Lieut. governor, secy. of state, atty. general, treasr., auditor; elected; terms, 4 years.

Judiciary: Supreme court—7 justices, elected at large; term, 12 years. Courts of appeals—3, 3 judges elected for each court; term, 12 years. Circuit court—39 circuits; judges elected; term, 6 years. Probate courts, magistrate courts—1 of each in each county; judges elected; term, 4 years.

County: 114 counties, each governed by a county court of 3 members, except those adopting an alternative form of government or having their own charter.

Municipal: Mayor and council most common; some have commissioners or city managers. St. Louis has a mayor and board of aldermen.

Voting Qualifications: Age, 21, residence in state, 1 year; in county and district, 60 days.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 6,700 miles. First railroad, St. Louis to Cheltenham, 1852. Rural roads, 99,800 miles. Airports, 104.

Communication: Periodicals, 201. Newspapers, 472. First newspaper, *Missouri Gazette*, St. Louis, 1808. Radio stations (AM and FM), 63; first station, WEW, St. Louis, licensed April 26, 1921. Television stations, 8; first station, KSD-TV, St. Louis, began operation Feb. 8, 1947. Telephones, 1,288,700. Post offices, 1,438.

THE PEOPLE AND THEIR LAND

Population (1950 census): 3,954,653 (rank among 48 states—11th); urban, 61.5%; rural 38.5%. Density: 57.1 persons per square mile (rank—25th state).

Extent: Area, 69,674 square miles, including 448 square miles of water surface (18th state in size).

Elevation: Highest, Taum Sauk Mt., 1,772 ft., near Hogan; lowest, St. Francis R. at south border, 230 ft.

Temperature (°F.): Average—annual, 55°; winter, 33°; spring, 55°; summer, 76°; fall, 57°. Lowest recorded, −40° (Warsaw, Feb. 13, 1905); highest recorded, 118° (Lamar, July 18, 1936, and other locations and dates).

Precipitation: Average (inches)—annual, 40; winter, 6; spring, 12; summer, 12; fall, 10. Varies from about 32 in northwest to about 50 in southeast.

Natural Features: Upland plain or prairies in northern section; lowlands in southeastern section; between these two sections, Ozark Highlands cross diagonally from Sainte Genevieve to southwest corner. Principal rivers: Chariton, Gasconade, Grand, Meramec, Mississippi (on eastern border), Missouri, Osage, Platte, St. Francis, and White.

Land Use: Cropland, 31%; nonforested pasture, 25%; forest, 34%; other (roads, parks, game refuges, wasteland, cities, etc.) 10%.

Natural Resources: *Agricultural*—adequate rainfall, fertile land and climate suitable for cotton, hay, and grains. *Industrial*—cheap source of power in coal fields and rivers; deposits of lead, cement, limestone, building stone, lime, sand and gravel, clays; forest land. *Commercial*—Mississippi and Missouri rivers as waterways.

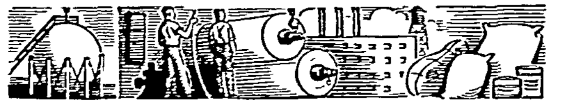
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Manufacturing	331,885	21.9
Wholesale and retail trade	298,261	19.6
Agriculture, forestry, and fishery	267,860	17.6
Transportation, communication, and other public utilities	134,652	8.8
Professional services (medical, legal, educational, etc.)	118,499	7.8
Construction	84,447	5.5
Personal services (hotel, domestic, laundering, etc.)	83,344	5.5
Government	60,330	4.0
Finance, insurance, and real estate	50,489	3 3
Business and repair services	37,741	2.5
Amusement, recreation, and related services	12,838	0.8
Mining	9,532	0.6
Workers not accounted for	31,939	2.1
Total employed	1,521,817	100.0

Missouri Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—13th)
Value added by manufacture* (1952), $2,351,377,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
FOOD AND KINDRED PRODUCTS.... Malt liquors; meat packing; flour and meal; bakery products	$331,753,000	8
TRANSPORTATION EQUIPMENT..... Motor vehicles and parts	173,131,000	9
APPAREL AND RELATED PRODUCTS. Women's and misses' outerwear; men's and boys' furnishings	130,549,000	7
CHEMICALS AND ALLIED PRODUCTS. Drugs and medicines; industrial chemicals; paints and varnishes	129,257,000	15
LEATHER AND LEATHER PRODUCTS. Footwear, except rubber	117,333,000	4
PRINTING AND PUBLISHING....... Newspapers; commercial printing	116,327,000	20
FABRICATED METAL PRODUCTS .	112,587,000	12

* For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—11th)
Total cash income (1952), $1,090,758,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Hogs...........	1,262,825,000 lbs.	1	5
Cattle..........	913,810,000 lbs.	2	5
Corn...........	142,318,000 bu.	3	7
Milk...........	1,830,000,000 qts.	4	11
Eggs...........	222,000,000 doz.	5	5
Hay...........	4,387,000 tons	6	6
Cotton lint.....	375,000 bales	7	12
Wheat.........	22,658,000 bu.	8	16

*Rank in dollar value †Rank in units produced

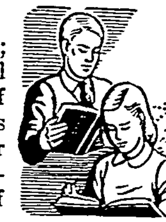
C. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $135,246,000
Rank among states—22d

Minerals (1951)	Amount Produced	Value
Lead..................	124,000 tons	$42,801,000
Cement...............	10,217,000 bbls.	25,760,000
Stone.................	11,294,000 tons	15,255,000
Coal..................	3,269,000 tons	13,405,000
Lime..................	1,122,000 tons	11,286,000
Clays.................	1,904,000 tons	10,098,000

D. Trade

Trade (1948)	Sales	Rank among States
Wholesale...........	$7,504,189,000	7
Retail.............	3,568,337,000	10
Service.............	342,741,000	10

EDUCATION



Public Schools: Elementary, 5,113; secondary, 650. Compulsory school age, 7 through 15. State Board of Education consists of 8 lay members appointed by the governor for 8-year terms. State commissioner of education appointed by State Board of Education for indefinite term. County supts. elected for 4-year terms. County boards of education consist of 6 members elected for 3-year terms. City school directors elected for 3-year terms; 6-year terms in St. Louis. City superintendents appointed by city school boards for 1- to 3-year terms.

Private and Parochial Schools: 516.

Colleges and Universities (accredited): Colleges—white, 24; Negro, 2. Junior colleges—white, 18. State-supported institutions include the University of Missouri, Columbia, with its School of Mines and Metallurgy at Rolla; 1 state teachers college—Northeast at Kirksville; 4 state colleges—Central at Warrensburg, Northwest at Maryville, Southeast at Cape Girardeau, and Southwest at Springfield; Lincoln University (for Negroes), Jefferson City, with its College of Law in St. Louis.

State Schools for Handicapped: Missouri School for Blind, St. Louis; Missouri School for Deaf, Fulton.

Libraries: City and town public libraries, 154; independent county library systems, 43; 10 cities contract for service with county libraries; 6 regional libraries serve 15 counties. State library responsible for aid in developing library service; work headed by state librarian. Noted special libraries: Linda Hall Library, Kansas City; Academy of Science, Missouri Botanical Gardens, Missouri Historical Society, all in St. Louis.

Outstanding Museums: City Art Museum, St. Louis; St. Joseph Art Museum, St. Joseph; Springfield Art Museum, Springfield; Mark Twain Museum, Hannibal; Missouri State Museum, Jefferson City; Kansas City Museum and William Rockhill Nelson Gallery of Art, both in Kansas City.

CORRECTIONAL AND PENAL INSTITUTIONS

Training School for Boys, Boonville; Training School for Girls, Chillicothe; Training School for Negro Girls, Tipton; Intermediate Reformatory for Young Men, State Penitentiary, and Women's Branch, all in Jefferson City.

STATE PARKS*†

Arrow Rock—little village on old Santa Fe Trail; Old Tavern restored; two historical museums (9).
Bennett Spring—large springs put forth 100 million gallons of water a day; trout fishing; near Lebanon (25).
Big Spring—840 million gals. of water have flowed daily from state's largest single spring; near Van Buren (38).
Cuivre River—popular recreational area near Troy (14).
Knob Noster—group camping; near Warrensburg (11).
Lake of the Ozarks—large lake formed by Bagnell Dam; excellent setting for recreation; near Camdenton (18).
Mark Twain—house in which author was born (moved from Florida, Mo.), now a museum; near Perry (6).
Meramec—large woodland park with a variety of recreational facilities; caverns; near Sullivan (19).
Montauk—3 streams originating in springs from Current River; trout fishing; forests; near Salem (27).

*Numbers in parentheses are keyed to map.
†There are 25 state parks: 13 are listed here.

Missouri Fact Summary

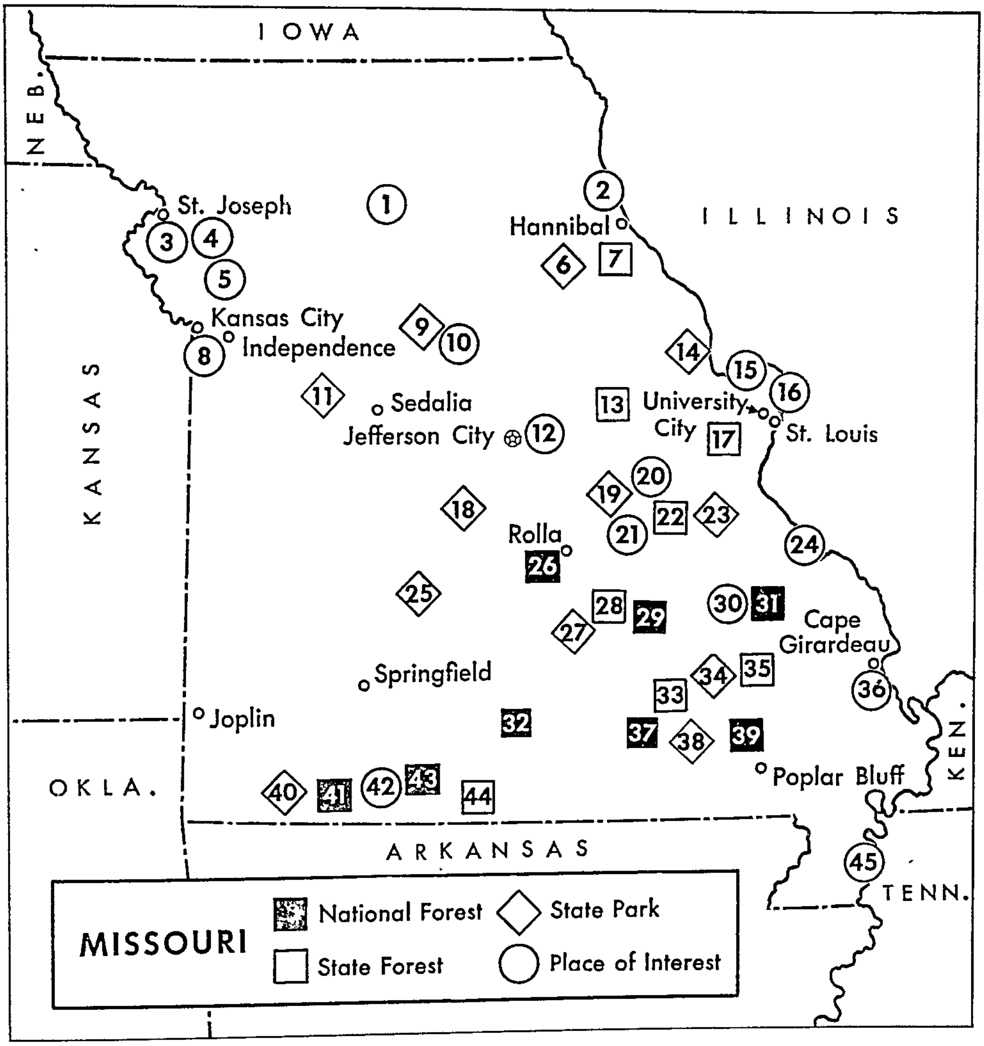
Roaring River—underground river forms lake; near Cassville (40).
Sam A. Baker—rugged wilderness on Big Creek; near Patterson (34).
Thousand Hills—lake; under development; near Kirksvillė; n. e. of (1).
Washington—near De Soto; ancient Indian carvings upon hillside (23).

STATE FORESTS*

Caney Mountain (near Gainesville)—5,527 acres (44).
Daniel Boone (near Jonesburg)—2,250 acres (13).
Deer Run† (near Ellington)—115,107 a. (33).
DuPont (near Ashburn) —1,242 acres (7).
Indian Trail (near Salem) —13,256 acres (28).
Meramec† (near Sullivan) —3,438 acres (22).
Rockwoods (near Pacific) —3,396 acres (17).
Sam A. Baker† (near Patterson)—10,666 acres (35).

NATIONAL FORESTS*

Clark—1,971,895 acres; hdqrs., Rolla (29, 31, 37, 39).
Mark Twain—1,349,618 acres; hdqrs., Springfield (26, 32, 41, 43).



PLACES OF INTEREST*

Cape Girardeau—at Cape Rock Park a marker commemorates trading post established about 1733 (36).
Excelsior Springs—popular health resort (5).
George Washington Carver National Monument—birthplace and home of noted Negro scientist; near Joplin.
Hannibal—where Mark Twain grew up; Mark Twain Home and Museum; Becky Thatcher House and Mark Twain Cave described in 'Tom Sawyer' (2).
Independence—home of Harry S. Truman; Jackson Co. Courthouse, one-story log cabin built in 1827 (8).
Indian Mound—large mound near Caruthersville (45).
Jefferson City—State Capitol; Executive Mansion; Lincoln University (*see* Jefferson City) (12).
Jefferson National Expansion Memorial National Historic Site—commemorates territorial expansion (16.)
Kansas City—such places of interest as the Liberty Memorial and many museums (*see* Kansas City, Mo.) (8).
Marvel Cave—immense cave near Branson (42).
Meramec Caverns—near Stanton; 5 floors in cave (20).
O. O. McIntyre's Birthplace—in Plattsburg (4).
Old Fort Bellefontaine—built 1806 on Missouri R. (16).
Old Franklin (Site)—head of Santa Fe Trail; 1st trip made 1821; line of s.w. expansion for 50 years (10).
Old State Capitol—St. Charles; built in 1814 (15).
Onondaga Cave—underground caves; near Leasburg (21).
Pershing House—boyhood home of Gen. John J. Pershing; in Laclede (1).
Pilot Knob—600-ft. hill; Civil War observation post (30).
Ste. Genevieve—oldest town in state (1735); Jean Baptiste Vallé House and Vital de St. Gemme de Beauvais House, both examples of Creole dwellings (24).
St. Joseph—Pony Express Stables, the starting point of the famous mail service; Jesse James House where the outlaw was killed by reward seekers (3).
St. Louis—such places as Forest Park, Old Courthouse, Missouri Botanical Garden (*see* Saint Louis) (16).
Also fishing and other water sports at Clearwater Reservoir and Wappapello Reservoir, both south of (30); Lake Taneycomo (42); Bull Shoals Reservoir (42); and Norfork Reservoir, east of (42).

LARGEST CITIES (1950 census)

St. Louis (856,796): industrial and railroad center; Mississippi R. port; meat packing; fur market; shoes.
Kansas City (456,622): manufacturing and railroad center on Missouri River; livestock and wheat market.
St. Joseph (78,588): livestock market; railroad shops.
Springfield (66,731): Ozark resort and trade center.
University City (39,892): adjoins St. Louis on west.
Joplin (38,711): hub of tristate lead and zinc region.
Independence (36,963): home of Harry S. Truman.
Columbia (31,974): educational center; Univ. of Missouri.
Jefferson City (25,099): state capital; trade center.

* Numbers in parentheses are keyed to map.
† Made up of scattered rather than joined tracts.

Missouri Fact Summary

THE PEOPLE BUILD THEIR STATE

1673—Joliet and Father Marquette explore Mississippi River; discover mouth of Missouri River.

1682—La Salle descends Mississippi River; claims valley for France.

1700—Jesuit mission established on present site of St. Louis; abandoned, 1703.

1715—La Mothe Cadillac discovers lead ore near present Mine La Motte.

1719—Claude Charles du Tisne explores Missouri River from its mouth to present Saline County.

1723—Philip Renault begins to work lead mines; imports first Negro slaves. Étienne de Bourgmont builds Ft. Orleans on Missouri R. in present Carroll Co.

1735—Ste. Genevieve, first permanent white settlement in Missouri, founded by the French.

1762—France cedes to Spain area west of Mississippi R. Spain secretly cedes it back to France, 1800.

1764—Pierre Laclede Ligueste founds St. Louis.

1765—French headquarters in Upper Louisiana moves to St. Louis; remains there until first Spanish governor, Don Pedro Piernas, arrives, 1770.

1803—Missouri becomes U. S. territory through Louisiana Purchase; Upper Louisiana is formally transferred to U. S. in ceremony at St. Louis, March 9, 1804.

1804—Settlers protest inclusion of present Missouri in Indiana Territory. Lewis and Clark leave St. Louis on trip up Missouri River and to Pacific.

1805—Missouri becomes part of Territory of Louisiana

1809—St. Louis Missouri Fur Company organized.

1812—Territory of Missouri organized, October 1; territorial borders correspond to present state lines; capital, St. Louis; governor, Benjamin Howard.

1817—Steamship *Pike* reaches St. Louis from New Orleans.

1819—*Independence*, first steamboat on Missouri River, reaches Franklin.

1820—Missouri Compromise authorizes Missouri to form state constitution without restriction on slavery.

1821—Missouri admitted to the Union as a slave state, August 10; capital, St. Charles; governor, Alexander McNair. François Chouteau establishes trading post on site of present Kansas City. Capt Wm. Becknell inaugurates Missouri-Santa Fe trade.

1823—Donkeys brought to Howard County from New Mexico start development of the "Missouri mule."

1826—State capital moved to Jefferson City.

1829—Jesuits establish college at St. Louis; incorporated as St. Louis University, 1832.

1835—Samuel L. Clemens (Mark Twain), born in Florida, Mo.; spends childhood and youth in Hannibal.

1837—Platte Purchase (now six northwestern counties) ends Indian claims to present Missouri.

1839—University of Missouri chartered.

1855—Missouri-Kansas border war over slavery begins.

1859—Hannibal and St. Joseph R.R. is first to cross state.

1860—Pony Express, St. Joseph to California, begins.

1861—State convention called to consider state's relation to Union; becomes pro-Union. Battle of Boonville is first engagement of Civil War in Missouri.

1862—Battle of Pea Ridge, March 8, in northwest Arkansas prevents invasion of Missouri.

1864—General Sterling Price leads Confederate army in famous raid into Missouri.

1866—Lincoln Institute (now Lincoln University) for Negroes opened at Jefferson City; is first institution of its kind for Negroes in U. S.

1878—Joseph Pulitzer merges St. Louis *Post* and *Dispatch* as first major step in his journalistic career.

1882—Jesse James killed at St. Joseph, thus ending post-Civil War outlawry in Missouri.

1904—Louisiana Purchase Exposition held at St. Louis.

1907—State adopts primary election law.

1921—Harry S. Truman takes first public office, Jackson Co. highway overseer; elected U. S. senator, 1934; vice-president, 1944; 33d president of U. S., 1948.

1927—Charles A. Lindbergh crosses Atlantic in *Spirit of St. Louis;* financed by St. Louis businessmen.

1931—Bagnell Dam forms Lake of the Ozarks on Osage R.

1934—Congress creates commission to develop memorial to Thomas Jefferson near St. Louis.

1945—New state constitution adopted.

1949—Plants for making synthetic oil from coal dedicated at Louisiana.

1951—Flood waters of Kansas River greatly damage Kansas City, Mo., and overflow the Missouri River.

1952—One of worst floods of Missouri River, inundates towns and farmlands in Missouri.

1953—Drought seriously affects agriculture in state.

INDEX TO THE MAP OF MISSOURI

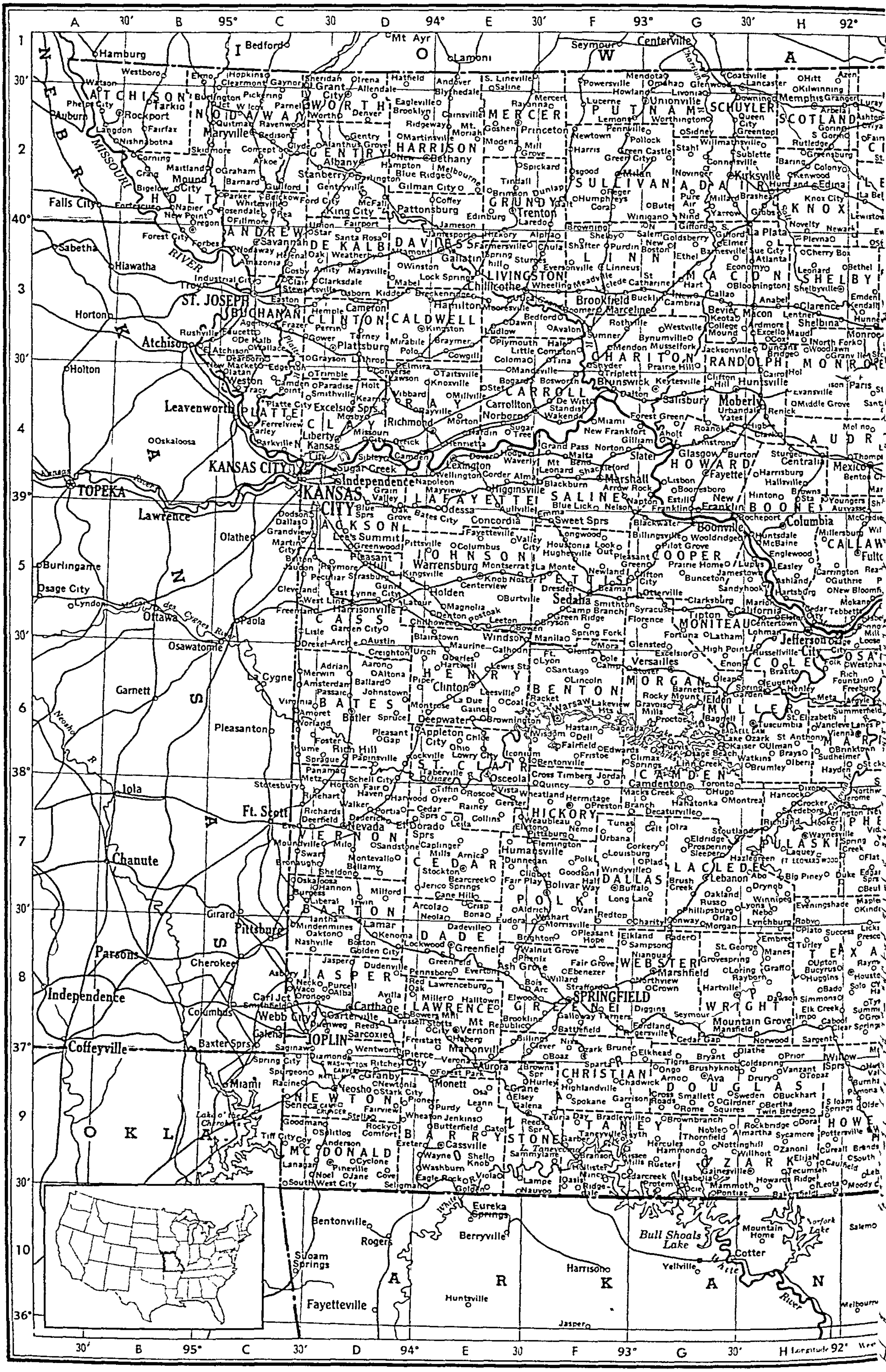
COUNTIES

Adair	19,689	G 2
Andrew	11,727	C 3
Atchison	11,127	B 2
Audrain	23,829	J 4
Barry	21,755	E 9
Barton	12,678	D 7
Bates	17,534	D 6
Benton	9,080	F 6
Bollinger	11,019	M 8
Boone	48,432	H 4
Buchanan	96,826	C 3
Butler	37,707	M 9
Caldwell	9,929	E 3
Callaway	23,316	J 5
Camden	7,861	G 6
Cape Girardeau	38,397	N 8
Carroll	15,589	F 4
Carter	4,777	L 9
Cass	19,325	D 5
Cedar	10,663	E 7
Chariton	14,944	G 3
Christian	12,412	F 9
Clark	9,003	J 2
Clay	45,221	D 4
Clinton	11,726	D 3
Cole	35,464	H 6
Cooper	16,608	G 5
Crawford	11,615	K 7
Dade	9,324	E 8
Dallas	10,392	F 7
Daviess	11,180	E 3
De Kalb	8,047	D 3
Dent	10,936	J 7
Douglas	12,638	G 9
Dunklin	45,329	M 10
Franklin	36,046	K 6
Gasconade	12,342	J 6
Gentry	11,036	D 2
Greene	104,823	F 8
Grundy	13,220	E 2
Harrison	14,107	E 2
Henry	20,043	E 6
Hickory	5,387	F 7
Holt	9,833	B 2
Howard	11,857	G 4
Howell	22,725	J 9
Iron	9.458	L 7
Jackson	541,035	D 5
Jasper	79,106	D 8
Jefferson	38,007	L 6
Johnson	20,716	E 5
Knox	7,617	H 2
Laclede	19,010	G 7
Lafayette	25,272	E 4
Lawrence	23,420	E 8
Lewis	10,733	J 2
Lincoln	13,478	L 4
Linn	18,865	F 3
Livingston	16,532	E 3
McDonald	14,144	D 9
Macon	18,332	G 3
Madison	10,380	M 8
Maries	7,423	J 6
Marion	29,765	J 3
Mercer	7,235	E 2
Miller	13,734	H 6
Mississippi	22,551	O 9
Moniteau	10,840	G 5
Monroe	11,314	H 3
Montgomery	11,555	K 5
Morgan	10,207	G 6
New Madrid	39,444	N 9
Newton	28,240	D 9
Nodaway	24,033	C 2
Oregon	11,978	K 9
Osage	11,301	J 6
Ozark	8,856	H 9
Pemiscot	45,624	N 10
Perry	14,890	N 7
Pettis	31,577	F 5
Phelps	21,504	J 7
Pike	16,844	K 4
Platte	14,973	C 4
Polk	16,062	F 7
Pulaski	10,392	H 7
Putnam	9,166	F 2
Ralls	8,686	J 3
Randolph	22,918	G 3
Ray	15,932	E 4
Reynolds	6,918	L 8
Ripley	11,414	L 9
St. Charles	29,834	L 5
St. Clair	10,482	E 6
Sainte Genevieve	11,237	M 7
Saint Francois	35,276	M 7
Saint Louis	406,349	M 5
Saint Louis City	856,796	M 5
Saline	26,694	F 4
Schuyler	5,760	G 2
Scotland	7,332	H 2
Scott	32,842	N 8
Shannon	8,377	K 8
Shelby	9,730	H 3
Stoddard	33,463	N 9
Stone	9,748	F 9
Sullivan	11,299	F 2
Taney	9,863	F 9
Texas	18,992	J 8
Vernon	22,685	D 7
Warren	7,666	K 5
Washington	14,689	L 7
Wayne	10,514	L 8
Webster	15,072	G 8
Worth	5,120	D 2
Wright	15,834	H 8

CITIES AND TOWNS

Aaron	15	D 6
Abo		H 7
Acorn		L 9
Adrian	905	D 6
Advance	733	N 8
Affton	5,000	P 3
Agency	234	C 3
Aholt		G 4
Aid	55	M 9
Airport Drive	225	*D 8
Alanthus Grove	45	D 2
Alba	352	D 8
Albany	1,850	D 2
Aldrich	198	F 7
Alexandria	465	K 2
Allbright		M 8
Allendale	142	D 2
Allenton		N 3
Allenville	125	N 8
Alley Spring		K 8
Alma	357	E 4
Almartha		H 9
Alpha	25	F 3
Altamont	178	D 3
Altenburg	272	O 7
Alton	571	K 9
Altona	13	D 6
Amazonia	308	C 3
Americus		J 5
Amity	128	D 3
Amoret	255	C 6
Amsterdam	160	C 6
Anabel	25	H 3
Ancell	295	N 8
Anderson	1,073	D 9
Andover	18	E 1
Annada	93	L 4
Annapolis	490	L 8
Anniston	377	O 9
Anthonies Mill		K 6
Anutt	250	J 7
Apex		L 4
Appleton (Old Appleton)	120	N 7
Appleton City	1,150	E 6
Aquilla	50	N 9
Arab		M 8
Arbela	87	H 2
Arbor Terrace	1,150	*P 3
Arbyrd	679	M 10
Arcadia	414	L 7
Archie	300	D 5
Arcola	125	E 7
Ardmore	25	H 3
Argyle	162	J 6
Arkoe	48	C 2
Arlington		H 7
Armstrong	424	G 4
Arnica	4	E 7
Arno		G 9
Arrow Rock	170	F 4
Asbury	210	C 8
Ash Grove	970	E 8
Ashburn	153	K 3
Ashland	416	H 5
Ashley	205	K 4
Ashton		J 2
Atherton	375	R 5
Atlanta	438	H 3
Augusta	218	M 3
Aullville	123	E 4
Aurora	4,153	E 9
Austin	40	D 5
Auxvasse	507	J 4
Ava	1,611	G 9
Avalon	200	F 3
Avert	45	N 9
Avilla	142	D 8
Avondale	532	P 5
Azen		H 1
Bachelor	20	J 5
Bado	15	H 8
Bagnell	74	G 6
Bakersfield		H 9
Ballard	49	D 6
Ballwin	600	O 3
Banner		L 7
Bardley	75	K 9
Baring	274	H 2
Barnard	275	C 2
Barnesville	12	G 3
Barnett	200	G 6
Barry	30	P 5
Bartlett	15	K 8
Bates City	87	E 5
Battlefield		F 8
Bay		J 5
Beaman	45	F 5
Bearcreek	41	E 7
Beaufort	250	K 6
Beck		P 4
Bedford	50	F 3
Bedison	13	C 2
Bel-Nor	1,290	*P 3
Bel-Ridge	1,116	*P 3
Belgique	66	N 7
Belgrade		L 7
Bell City	482	N 8
Bella Villa	557	*P 3
Bellamy	25	D 7
Belle	906	J 6
Bellefontaine		O 3
Bellerive	180	*P 3
Belleview		L 7
Bellflower	226	K 4
Belton	1,233	C 5
Bem	18	K 6
Bennett	3	L 9
Benton	546	O 8
Benton City	141	J 4
Bentonville	11	F 6
Berdell Hills	583	*P 3
Berger	210	K 5
Berkeley	5,268	P 2
Bernie	1,308	M 9
Bertha	80	H 9
Bertrand	390	O 9
Bessville		N 8
Bethany	2,714	E 2
Bethel	194	J 3
Beulah	110	J 7
Beverly	29	O 4
Beverly Hills	938	*P 3
Bevier	838	G 3
Big Piney	80	H 7
Bigelow	132	B 2
Billings	597	F 8
Billingsville	10	G 5
Billmore		K 9
Birch Tree	409	K 9
Birdspoint		O 9
Birmingham	236	P 5
Bismarck	1,244	L 7
Bixby	20	K 7
Black		L 7
Black Jack	700	P 2
Blackburn	306	F 4
Black Walnut	20	P 2
Blackwater	313	G 5
Blairstown	199	E 5
Bland	596	J 6
Bliss	20	L 6
Blodgett	218	O 8
Bloomfield	1,382	M 9
Bloomington	18	H 3
Bloomsdale		M 6
Blue Lick		F 4
Blue Ridge	27	D 2
Blue Springs	1,068	R 6
Blythedale	238	E 2
Boaz	26	F 8
Bogard	285	E 4
Bois d' Arc		F 8
Bolckow	250	C 2
Boles		M 3
Bolivar	3,482	F 7
Bona	12	E 7
Bonfils	125	O 2
Bonne Terre	3,533	L 7
Bonnots Mill	150	J 5
Boomer	30	F 3
Boonesboro	46	G 4
Boonville	6,686	G 5
Boss	108	K 7
Boston	52	D 8
Bosworth	503	F 4
Bourbon	543	K 6
Bowen	30	E 5
Bowers Mill	29	E 8
Bowling Green	2,396	K 4
Bradleyville	69	F 9
Bragg City	294	N 10
Braggadocio	350	N 10
Branch		G 7
Brandsville	204	J 9
Branson	1,314	F 9
Brashear	119	H 2
Brasher	152	N 10
Braymer	955	E 3
Brays		H 6
Brazil	25	K 7
Brazito	25	H 6
Breckenridge	617	E 3
Breckenridge Hills	4,063	*P 3
Brentwood	7,504	P 3
Brewer		N 7
Brickeys		M 6
Bridgeton	202	P 2
Bridgeton Terrace	578	*P 3
Brighton	84	F 8
Brimson	139	E 2
Brinktown	48	J 6
Bronaugh	214	C 7
Brookfield	5,810	F 3
Brooklyn	30	D 2
Brookline		F 8
Broseley	177	M 9
Brownbranch	13	G 9
Browning	492	F 2
Brownington	179	E 6
Browns Spring		F 9
Browns Station	75	H 4
Brumley	78	H 6
Bruner	85	F 8
Brunot	31	M 8
Brunswick	1,653	F 4
Brush Creek	91	G 7
Brushy	14	K 8
Brushyknob		G 9
Bryant	6	G 8
Bryson	25	F 5
Buckhart	18	H 9
Buckhorn		M 8
Bucklin	783	G 3
Buckner	639	R 5
Bucoda	20	M 10
Bucyrus	25	H 8
Buell	69	K 4
Buffalo	1,213	F 7
Buick	101	K 7
Bunceton	556	G 5
Bunker		K 8
Burch		M 8
Burfordville	88	N 8
Burgess	123	C 7
Burlington Jct.	746	B 2
Burnham	74	J 9
Burton	11	G 4
Burtville	75	E 5
Busch	3	K 3
Bute		G 2
Butler	3,333	D 6
Butterfield	136	E 9
Butts	90	K 7
Bynumville	75	G 3
Byrnesville	45	N 4
Cabool	1,245	H 8
Cainsville	618	E 2
Cairo	264	H 4
Caledonia	143	L 7
Calhoun	463	E 6
California	2,627	H 5
Callao	370	G 3
Calverton Park	514	*P 2
Camden	383	D 4
Camden Point	147	C 4
Camdenton	1,142	G 6
Cameron	3,570	D 3
Camp Branch	12	F 5
Campbell	1,931	M 9
Campbellton	9	K 5
Canalou	438	N 9
Cane Hill		E 7
Canton	2,490	J 2
Cape Girardeau	21,578	O 8
Caplinger Mills	91	E 7
Cardwell	952	M 10
Carl Junction	1,006	C 8
Carrington	18	H 5
Carrollton	4,380	E 4
Carterville	1,552	D 8
Carthage	11,188	D 8
Caruth	150	N 10
Caruthersville	8,614	N 10
Case	10	K 5
Cassville	1,441	E 9
Castlewood	300	O 3
Catawissa	121	N 4
Cato		E 9
Catron	278	N 9
Caulfield	58	H 9
Cedar City	600	H 5
Cedar Gap	45	G 8
Cedar Hill	250	L 6
Cedar Springs		E 7
Cedarcreek	50	G 9
Cedargrove		J 8
Celt	50	G 7
Centaur Station	25	N 3
Center	415	J 3
Centertown	248	H 5
Centerview	179	E 5
Centerville	350	L 8
Centralia	2,460	H 4
Chadwick	175	F 9
Chaffee	3,134	N 8
Chain of Rocks	38	M 2
Chamois	621	J 5
Chandler	15	R 4
Charity		G 7
Charlack	1,528	*P 3
Charleston	5,501	O 9
Cherry Box	34	H 3
Cherryville	25	K 7
Chesterfield	351	O 3
Chicopee	100	K 9
Chilhowee	335	E 5
Chillicothe	8,694	E 3
Chilton	35	L 9
Chloe		E 6
Chloride		L 8
Chula	314	F 3
Clair	10	C 3
Clarence	1,123	H 3
Clark	276	H 4
Clarksburg	366	G 5
Clarksdale	282	D 3
Clarksville	702	K 4
Clarkton	1,004	M 10
Claryville	16	N 7
Claycomo	808	*D 4
Clayton	16,035	P 3
Clear Springs		J 8
Clearmont	283	C 1
Cleveland	163	C 5
Clever	273	F 8
Clifton City	109	G 5
Clifton Hill	262	G 4
Climax Springs	151	G 6
Clinton	6,075	E 6
Cliquot	52	F 7
Clubb		M 8
Clyde	115	C 2
Coal	33	E 6
Coatsville		G 1
Cockrell	12	R 6
Coffey	253	E 2
Coffman		M 7
Coldspring	15	H 9
Cole Camp	813	F 6
College Mound	89	G 3
Collins	199	E 7
Coloma	30	E 3
Colony	40	H 2
Columbia	31,974	H 5
Columbus	9	E 5
Commerce	360	O 8
Como	30	N 9
Conception		C 2
Conception Jct.	285	C 2
Concordia	1,218	E 5
Connelsville	113	G 2
Conran		N 10
Converse	14	D 4
Conway	514	G 7
Cook Station	60	K 7
Cooper Hill	55	J 6
Cooter	490	N 10
Cora	33	F 2
Corder	541	E 4
Corkery	5	G 7
Corning	184	B 2
Cornwall	100	M 7
Corridon	24	L 8
Corso	40	K 4
Cosby	142	C 3
Cottleville	162	N 2
Couch	78	K 9
Country Club Hills	1,731	P 2
Country Life Acres	57	*P 3
Courtney	175	R 5
Courtois		K 7
Cove		D 9
Cowgill	241	E 3
Cox	18	H 3
Coy	24	C 9
Craig	578	B 2
Crane	939	E 9
Creighton	269	D 6
Crescent	200	O 3
Crestwood	1,645	*P 3
Creve Coeur	2,040	O 3
Crisp	16	E 7
Crocker	712	H 7
Cross Roads		G 9
Cross Timbers	179	F 6
Crosstown	66	N 7
Crowder	133	N 9
Crown	23	G 8
Crystal City	3,499	M 6
Crystal Lake Pk.	167	*P 3
Cuba	1,301	K 6
Cureall	24	H 9
Curryville	258	K 4
Custer	6	K 7
Cyclone	7	D 9
Cyrene	67	K 4
Dadeville	208	E 8
Daisy	52	N 7
Dallas	102	P 6
Dalton	237	F 4
Danville	56	J 5
Dardenne	26	N 2
Darien		J 7
Darlington	217	D 2
Davis	27	L 4
Davisville	250	K 7
Dawn	170	E 3
Dawson	60	H 8
Day	25	F 9
De Kalb	300	C 3
De Soto	5,357	M 6
De Witt	254	F 4
Dearborn	391	C 3
Decaturville	25	G 7
Dederick	43	D 7
Deepwater	885	E 6
Deerfield	200	D 7
Deering	138	N 10
Defiance	120	N 3
Delaware		K 8
Dell		F 6
Delta	453	N 8
Denton	150	E 5
Denton	126	N 10
Denver	144	D 2
Des Arc	376	L 8
Des Peres	1,172	*P 3
Deslet	28	K 8
Desloge	1,957	M 7
Deventer	25	O 9
Dexter	4,624	N 9
Diamond	405	D 9
Diehlstadt	165	N 9
Diggins	126	G 8
Dillard	51	K 7
Dillon	175	J 7
Dixon	988	H 6
Dodson	1,500	P 6
Doe Run	900	M 7
Doniphan	1,611	L 9
Doolittle	237	*J 7
Dora	150	H 9
Dorena		O 9
Dover	173	E 4
Downing	453	H 2
Drake	50	K 6
Dresden	110	F 5
Drexel	456	C 6
Drury	24	H 9
Drynob		H 7
Dudenville	30	D 8
Dudley	319	M 9
Duenweg	500	D 8
Duke	30	H 7
Dumas	5	J 1
Duncans Bridge	65	H 3
Dunlap	60	F 2
Dunnegan		E 7
Durham	264	J 3
Dutchtown		N 8
Eagle Rock	30	E 9
Eagleville	360	D 2
Easley		H 5
East Atchison	110	C 3
East Kansas City	206	P 5
East Leavenworth	28	O 4
East Lynne	204	D 5
East Prairie	3,033	O 9
Easton	173	C 3
Ebenezer		F 8
Economy		H 3
Edgar Springs		J 7
Edgerton	408	C 4
Edina	1,607	H 2
Edinburg	100	E 2
Edmundson	621	*P 3
Edwards	35	F 6
Egypt Mills	35	O 8
El Dorado Springs	2,618	E 7
Eldon	2,766	G 6
Eldridge	145	G 7
Elijah	33	H 9
Elk Creek		H 8
Elkhead		G 8
Elkland	203	F 8
Elkton	55	F 7
Ellington	777	L 8
Ellisville	628	N 3
Ellsinore	299	L 9
Elmdale Village	641	*P 3
Elmer	295	G 3
Elmira	128	D 3
Elmo	258	B 1
Elmont	8	K 6
Elsberry	1,565	L 4
Elsey	105	E 9
Elston	110	H 5
Elvins	1,977	L 7
Elwood		F 8
Ely	30	J 3
Embree	15	H 8
Emden	63	J 3
Eminence	527	K 8
Emma	200	F 5
Englewood		H 5
Enon	41	G 6
Eolia	476	L 4
Essex	549	N 9
Estes	11	K 4
Esther	2,000	M 7
Estill	10	G 4
Ethel	226	G 3
Ethlyn	50	N 1
Etlah	23	K 5
Eudora	41	E 7
Eugene	180	H 6
Eureka	875	N 3
Evansville		H 4
Eve	50	C 7
Eveningshade		H 7
Eversonville	23	F 3
Everton	306	E 8
Ewing	316	J 2
Excello	95	H 3
Excelsior		G 6
Excelsior Sprs.	5,888	R 4
Exeter	355	D 9
Fagus	96	M 9
Fair Grove	308	F 8
Fair Haven	30	D 7
Fair Play	383	E 7
Fairdealing	45	L 9
Fairfax	806	B 2
Fairfield	43	F 6
Fairmont	36	J 2
Fairport	88	D 2
Fairview	259	D 9
Fanning		K 6
Farber	358	J 4
Farley	98	O 4
Farmersville	40	E 3
Farmington	4,490	M 7
Faro	75	M 8
Farrar	71	N 7
Faucett	170	C 3
Fayette	3,144	G 4
Fayetteville	100	E 5
Femme Osage	30	M 3
Fenton	207	O 3
Ferguson	11,573	P 2
Ferrelview	126	O 4
Festus	5,199	M 6
Fillmore	284	C 2
Fisk	542	M 9
Flat	35	J 7
Flat River	5,308	M 7
Flatwoods	112	L 9
Flemington	181	F 7
Fletcher	50	L 6
Flinthill	56	M 2
Flordell Hills	1,214	*P 3
Florence	100	G 5
Florida		J 4
Florissant	3,737	P 2
Floyd	30	S 5
Foley	203	L 4
Folk		H 6
Forbes	177	B 3
Ford City	59	C 2
Fordland	302	G 8
Forest City	484	B 3
Forest Green	100	G 4
Forest Park		E 9
Foristell	165	M 2
Fornfelt	1,539	O 8
Forsyth	354	F 9

*No room on map for name



A
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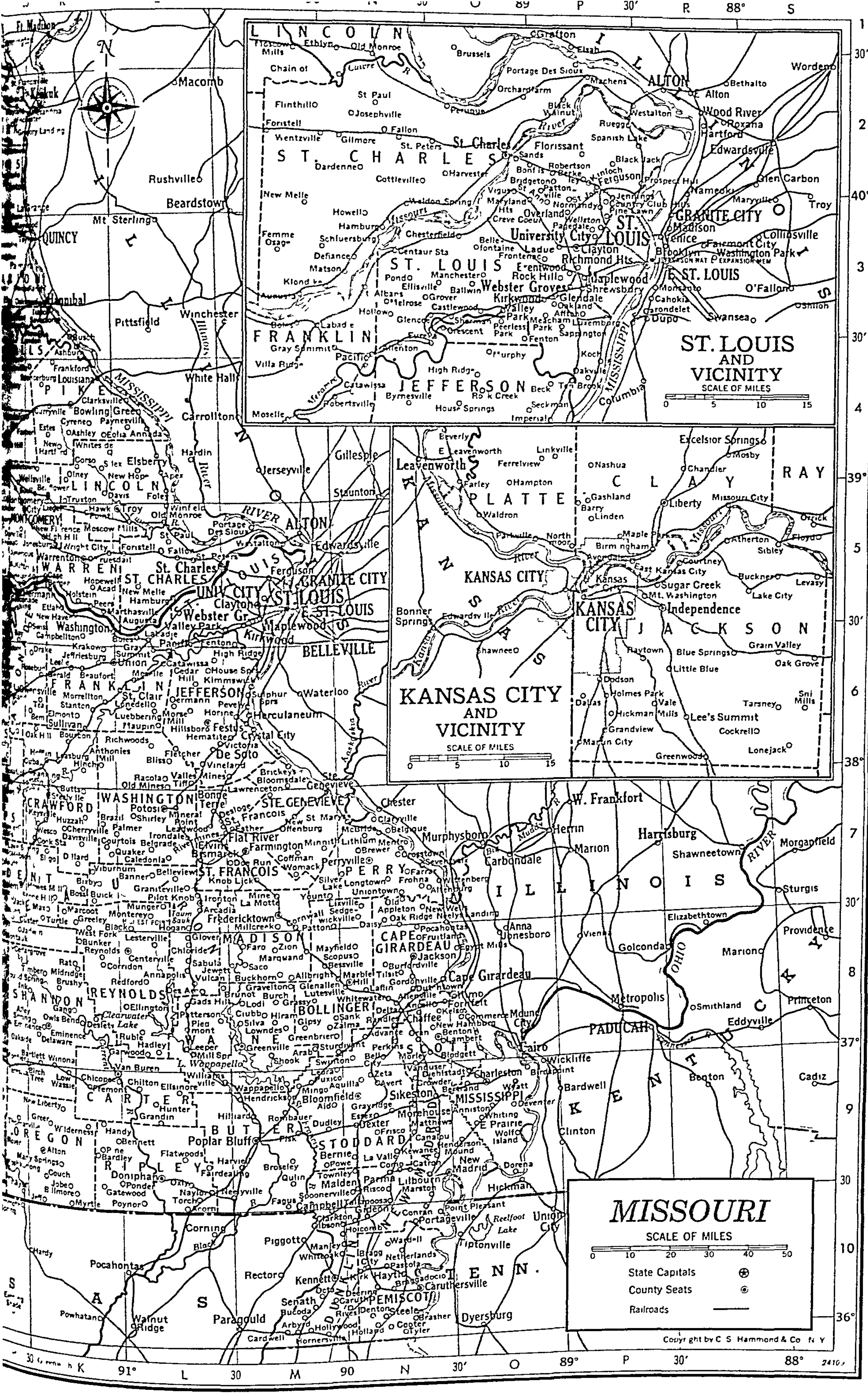
95°
94°
93°
92°
30′
40°
39°
38°
37°
36°
NEBR.
KANSAS
OKLA.
I O W A
ARKANSAS
ATCHISON
NODAWAY
WORTH
HARRISON
MERCER
PUTNAM
SCHUYLER
SCOTLAND
HOLT
ANDREW
GENTRY
DE KALB
DAVIESS
GRUNDY
SULLIVAN
ADAIR
KNOX
BUCHANAN
CLINTON
CALDWELL
LIVINGSTON
LINN
MACON
SHELBY
PLATTE
CLAY
RAY
CARROLL
CHARITON
RANDOLPH
MONROE
JACKSON
LAFAYETTE
SALINE
HOWARD
BOONE
AUDRAIN
CASS
JOHNSON
PETTIS
COOPER
MONITEAU
CALLAWAY
HENRY
BENTON
MORGAN
COLE
OSAGE
BATES
ST. CLAIR
HICKORY
CAMDEN
MILLER
MARIES
VERNON
CEDAR
POLK
DALLAS
LACLEDE
PULASKI
BARTON
DADE
GREENE
WEBSTER
WRIGHT
TEXAS
JASPER
LAWRENCE
CHRISTIAN
DOUGLAS
NEWTON
BARRY
STONE
TANEY
OZARK
HOWELL
McDONALD
ST. JOSEPH
KANSAS CITY
Independence
Springfield
JOPLIN
Sedalia
Jefferson City
Columbia
Topeka
Lawrence
Leavenworth
Atchison
Falls City
Iola
Chanute
Parsons
Independence
Coffeyville
Ft. Scott
Pittsburg
Fayetteville
Bull Shoals Lake
MISSOURI RIVER
Osage
White


MISSOURI
SCALE OF MILES
0 10 20 30 40 50
State Capitals
County Seats
Railroads
ST. LOUIS AND VICINITY
SCALE OF MILES
0 5 10 15
KANSAS CITY AND VICINITY
SCALE OF MILES
0 5 10 15
ST. CHARLES
ST. LOUIS
FRANKLIN
JEFFERSON
LINCOLN
PLATTE
CLAY
RAY
JACKSON
KANSAS CITY
ST. LOUIS
ALTON
GRANITE CITY
E. ST. LOUIS
UNIVERSITY CITY
Webster Groves
Kirkwood
Florissant
Ferguson
Clayton
Maplewood
Richmond Hts.
Leavenworth
Liberty
Independence
Lee's Summit
Bonner Springs
Excelsior Springs
QUINCY
Hannibal
Macomb
Rushville
Beardstown
Mt Sterling
Pittsfield
Winchester
White Hall
Carrollton
Jerseyville
Gillespie
Staunton
Edwardsville
BELLEVILLE
Waterloo
Herculaneum
Festus
Crystal City
De Soto
Ste. Genevieve
STE. GENEVIEVE
Chester
W. Frankfort
Herrin
Marion
Harrisburg
Murphysboro
Carbondale
Shawneetown
Morganfield
Sturgis
Anna
Jonesboro
Golconda
Metropolis
PADUCAH
Cairo
Wickliffe
Bardwell
Clinton
Hickman
Union City
Tiptonville
Dyersburg
Caruthersville
Kennett
Rector
Piggott
Corning
Pocahontas
Walnut Ridge
Paragould
Powhatan
Poplar Bluff
Doniphan
Van Buren
Cape Girardeau
Jackson
Perryville
Fredericktown
Farmington
Flat River
Potosi
Sikeston
Charleston
New Madrid
Bloomfield
Dexter
Malden
Campbell
Kennett
Union
Washington
Troy
Bowling Green
Louisiana
Clarksville
LINCOLN
PIKE
MONTGOMERY
WARREN
ST. CHARLES
FRANKLIN
CRAWFORD
WASHINGTON
IRON
ST. FRANCOIS
MADISON
PERRY
CAPE GIRARDEAU
BOLLINGER
REYNOLDS
SHANNON
WAYNE
CARTER
OREGON
RIPLEY
BUTLER
STODDARD
SCOTT
MISSISSIPPI
NEW MADRID
DUNKLIN
PEMISCOT
ILLINOIS
KENTUCKY
TENN.
MISSISSIPPI
OHIO RIVER
Illinois River
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91° 90 89° 88°
40° 39° 38° 37° 36°

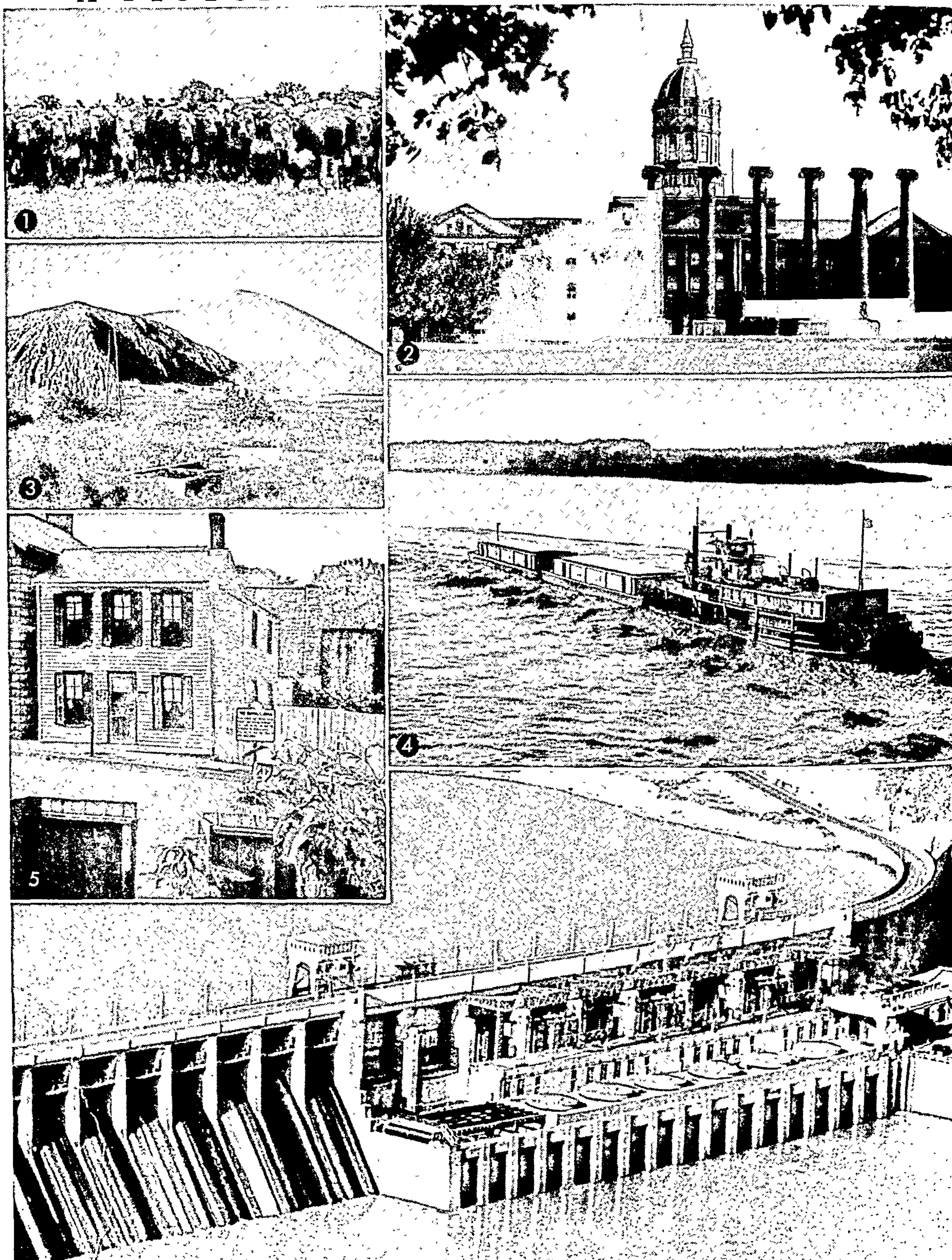
Fort Lyon	14	F 6
Fortescue	117	B 2
Fortuna	150	G 5
Foster	225	D 6
Frankford	449	K 4
Franklin	324	G 4
Frazer	25	C 3
Fredericktown	3,696	M 7
Freeburg	370	J 6
Freedom	35	J 6
Freeman	309	C 5
Freistatt	135	E 8
Fremont	207	K 9
Frisco	31	N 9
Fristoe	100	F 6
Frohna	208	N 7
Frontenac	1,099	O 3
Fruitland	150	N 8
Fulton	10,052	J 5
Gads Hill	10	L 8
Gaines	2	E 6
Gainesville	309	G 9
Galena	439	F 9
Gallatin	1,634	E 3
Galloway		F 8
Galt	409	F 2
Gang	50	K 8
Garber		F 9
Garden City	590	D 5
Garrison		F 9
Garwood		L 8
Gasconade	448	J 5
Gascondy	1	J 6
Gashland	1,200	P 5
Gatewood	75	K 9
Gaynor	12	C 1
Gentry	159	D 2
Gentryville	70	D 2
Gerald	429	K 6
Gerster	47	E 7
Gibbs	144	H 2
Gibson	117	*M 10
Gideon	1,754	N 10
Gifford	16	G 2
Gilliam	306	F 4
Gilman City	450	D 2
Gilmore	104	N 2
Gipsy		M 8
Girdner	25	G 9
Glasgow	1,440	G 4
Glen Echo Park	217	*P 3
Glenallen	107	M 8
Glencoe	250	N 3
Glendale	4,930	P 3
Glensted	39	G 5
Glenwood	258	G 1
Glover	134	L 8
Gobler	116	*N 10
Golden	650	E 9
Golden City	839	D 8
Goldsberry	33	G 3
Goodfellow Terrace	503	*P 3
Goodman	477	C 9
Goodson	60	F 7
Gordonville	130	N 8
Gorin	500	H 2
Goshen	15	E 2
Gower	350	C 3
Graff		H 8
Graham	311	C 2
Granby	1,670	D 9
Grain Valley	348	S 6
Grand Pass	124	F 4
Grandin	263	L 9
Grandview	1,556	P 6
Granger	122	H 2
Graniteville		L 7
Grant City	1,184	D 2
Grantwood	133	*P 3
Granville	105	H 3
Grassy		M 8
Gravelton	97	M 8
Gravois Mills	40	G 6
Gray Summit	250	M 3
Grayridge	253	N 9
Grayson	64	D 3
Greeley		K 7
Green Castle	287	G 2
Green City	673	F 2
Green Ridge	335	F 5
Greenbrier	59	M 8
Greenfield	1,213	E 8
Greensburg	40	H 2
Greentop	281	H 2
Greenville	270	M 8
Greenwood	400	R 6
Greer	20	K 9
Gregory Landing	33	K 2
Grogan		J 8
Grover	300	O 3
Grovespring	104	G 8
Guilford	164	C 2
Gunn City	57	D 5
Guthrie	65	H 5
Hadley		L 8
Hahatonka		G 7
Hale	452	F 3
Half Way	150	F 7
Hallsville	225	H 4
Halltown	99	E 8
Hamburg	30	N 3
Hamilton	1,728	E 3
Hammond		G 9
Hampton	20	O 4
Hancock	72	H 7
Handy	65	K 9
Hanley Hills	2,219	*P 3
Hannibal	20,444	K 3
Hannon	43	D 7
Hardin	747	E 4
Harris	181	F 2
Harrisburg	117	H 4
Harrisonville	2,530	D 5
Hart	32	G 3
Hartsburg	171	H 5
Hartshorn	63	J 8
Hartville	526	G 8
Hartwell	50	E 6
Harvester	75	O 2
Harviell	190	M 9
Harwood	141	D 7
Hastain		F 6
Hatfield	64	D 1
Hattie	114	J 8
Hawk Point	254	K 5
Hayden	11	H 6
Hayti	3,302	N 10
Hazelwood	336	*P 3
Hazlegreen	41	H 7
Helena		C 3
Hematite	250	L 6
Hemple	75	D 3
Henderson Mound	22	O 9
Hendrickson		M 9
Henley	64	H 6
Henrietta	462	E 4
Herculaneum	1,603	M 6
Hercules		G 9
Hermann	2,523	K 5
Hermitage	204	F 7
Hickman Mills	1,325	P 6
Hickory Creek	25	E 3
Higbee	674	H 4
Higginsville	3,428	E 4
High Hill	224	K 5
High Point		G 5
High Ridge		O 4
Highlandville	46	F 9
Hilliard	75	M 9
Hillsboro	390	L 6
Hillsdale	2,902	*P 3
Hinch	50	K 6
Hinton	40	H 4
Hiram	48	M 8
Hitt	15	H 1
Hoberg	90	E 8
Hobson	42	J 7
Hodge	141	E 4
Hofflin	2	K 6
Hogan	74	L 7
Holcomb	505	N 10
Holden	1,765	E 5
Holland	409	N 10
Holliday	196	H 3
Hollister	542	F 9
Hollow		N 3
Hollywood	79	M 10
Holmes Park	100	P 6
Holstein		K 5
Holt	270	D 4
Hooker	50	H 7
Hope	50	J 5
Hopewell Academy	25	K 5
Hopkins	825	C 1
Horine		M 6
Hornersville	875	M 10
Horton	48	D 7
House Springs	151	O 4
Houston	1,277	J 8
Houstonia	309	F 5
Howards Ridge	4	H 9
Howell		N 3
Howes Mill		K 7
Howland	4	F 1
Huggins	14	H 8
Hughesville	180	F 5
Hugo	10	G 7
Humansville	803	E 7
Hume	474	C 6
Humphreys	185	F 2
Hunnewell	293	J 3
Hunter	134	L 9
Huntleigh	180	*P 3
Huntsdale	50	H 5
Huntsville	1,520	H 4
Hurdland	268	H 2
Hurley	250	F 9
Hutton Valley	108	J 9
Huzzah		K 7
Iantha	166	D 8
Iatan		C 4
Iberia	595	H 6
Iconium	40	E 6
Ilasco		K 3
Illmo	1,247	O 8
Imperial		P 4
Impo		H 8
Independence	36,963	R 5
Industrial City	1,500	C 3
Ink	35	J 8
Ionia	120	F 6
Ira		G 7
Irena	15	D 1
Irondale	443	L 7
Ironton	1,148	L 7
Irwin	55	D 7
Isabella		G 9
Isbell Station		J 5
Jack	3	J 7
Jackson	3,707	N 8
Jacksonville	177	G 3
Jadwin	4	K 8
Jameson	185	E 2
Jamesport	720	E 3
Jamestown	245	G 5
Jane		D 9
Jasper	776	D 8
Jaudon	30	C 5
Jeff	10	K 9
JEFFERSON CITY	25,099	H 5
Jeffriesburg		K 6
Jenkins	39	E 9
Jennings	15,282	P 2
Jerico Springs	235	E 7
Jerome	250	J 7
Jewett	125	L 8
Jobe		K 9
Johnstown	24	D 6
Jonesburg	433	K 5
Joplin	38,711	D 8
Jordan		F 6
Josephville	70	N 2
Joy	25	J 8
Kahoka	1,847	J 2
Kaiser	50	G 6
Kansas City	456,622	P 5
Kearney	570	D 4
Kelso	276	O 8
Kendall	3	J 3
Kennett	8,685	M 10
Kenoma	65	D 8
Kenwood	15	H 2
Keota	35	G 3
Kewanee	96	N 9
Keysville	50	K 7
Keytesville	733	G 4
Kidder	222	D 3
Kilwinning	17	H 1
Kimmswick	207	M 6
Kinderpost		J 7
King City	1,031	D 2
Kingston	338	E 3
Kingsville	207	D 5
Kinloch	5,957	P 2
Kirk	40	N 10
Kirksville	11,110	H 2
Kirkwood	18,640	O 3
Kissee Mills	63	G 9
Klondike		M 3
Knob Lick		M 7
Knob Noster	585	E 5
Knox City	362	H 2
Knoxville	100	E 4
Koch	975	P 4
Koenig		J 6
Koshkonong	333	J 9
Krakow		K 6
La Belle	840	J 2
La Due		E 6
La Grange	1,106	K 2
La Monte	502	F 5
La Plata	1,331	H 2
La Valle	35	N 9
Labadie	300	N 3
Laclede	544	F 3
Laddonia	599	J 4
Ladue	5,386	P 3
Laflin	26	N 8
Lake City	25	S 5
Lake Ozark	350	G 6
Lake Spring	35	J 7
Lakeshire	295	*P 3
Lakeview Heights	30	F 6
Lamar	3,233	D 8
Lambert	39	O 8
Lampe		F 9
Lanagan	368	C 9
Lancaster	856	H 1
Lanes Prairie		J 6
Langdon		A 2
Lanton	66	J 9
Laquey	39	H 7
Laredo	426	E 2
Larussell	82	D 8
Latham	172	G 5
Lathrop	888	D 3
Latour	80	D 5
Lawrenceburg	53	E 8
Lawrenceton		M 6
Lawson	486	D 4
Leadwood	1,479	L 7
Leann	25	E 9
Leasburg	178	K 6
Lebanon	6,808	G 7
Lebo		J 9
Lecoma	55	J 7
Leeper	375	L 8
Lee's Summit	2,554	R 6
Leesville	72	E 6
Leeton	372	E 5
Leila	10	E 7
Lemons	176	F 2
Lenox	70	J 7
Lentner	65	H 3
Leonard	165	H 3
Leora	45	M 9
Leota	15	H 9
Leslie	114	K 6
Lesterville	163	L 8
Levasy	139	S 5
Lewis Station	33	E 6
Lewistown	415	J 2
Lexington	5,074	E 4
Liberal	739	D 7
Liberty	4,709	R 5
Licking	733	J 8
Liege	77	K 5
Lilbourn	1,361	N 9
Lincoln	316	F 6
Linden	800	P 5
Linkville	50	P 4
Linn	758	J 5
Linn Creek	162	G 6
Linneus	513	F 3
Lisbon	25	G 4
Lisle		C 5
Lithium	57	N 7
Little Blue	250	R 6
Little Compton		F 3
Livonia	193	G 1
Lixville		N 7
Lock Springs	137	E 3
Lockwood	791	E 8
Lodi	34	M 8
Lohman	123	H 5
Lonedell		L 6
Lonejack	200	S 6
Long Lane		G 7
Longhorn Village	41	*K 7
Longtown	139	N 7
Longwood	52	F 5
Look Out		F 5
Loose Creek		J 5
Loring		H 8
Louisburg		F 7
Louisiana	4,389	K 4
Low Wassie	44	K 9
Lowndes	100	M 8
Lowry City	493	E 6
Lucerne	227	F 2
Ludlow	260	E 3
Luebbering		L 6
Lupus	97	H 5
Luray	184	J 2
Lutesville	694	M 8
Luxemburg	18,000	P 3
Lynchburg	50	H 7
Lyons		H 7
Mabel	10	D 3
Machens	86	P 2
Mackenzie	247	*P 3
Macks Creek	108	G 7
Macon	4,152	H 3
Madison	571	H 4
Madisonville		J 4
Magnolia		E 5
Maitland	456	B 2
Malden	3,396	M 9
Malta Bend	414	F 4
Mammoth		G 9
Manchester		O 3
Mandeville	25	E 3
Manes	120	H 8
Manila	4	F 5
Manley	75	M 10
Mansfield	963	G 8
Many Springs	25	K 9
Maples	14	J 7
Maple Park		P 5
Maplewood	13,416	P 3
Marble Hill	454	N 8
Marceline	3,172	F 3
Marcoot		K 7
Margona	306	*P 3
Marion	50	H 5
Marionville	1,167	E 8
Marlborough	219	*P 3
Marquand	369	M 8
Marshall	8,850	F 4
Marshfield	1,925	G 8
Marston	610	N 9
Marthasville	347	L 5
Martinsburg	296	J 4
Martinsville	90	D 2
Martin City	350	P 6
Mary Ridge	528	*P 3
Maryland Heights		O 2
Maryville	6,834	C 2
Matson	60	N 3
Matthews	498	N 9
Maud	30	H 3
Maupin		L 6
Maurine	9	E 5
Max		K 7
Mayfield		M 8
Maysville	973	D 3
Mayview	268	E 4
Maywood	149	J 3
McBaine	75	H 5
McBride	75	N 7
McCredie	90	J 5
McFall	255	D 2
McKittrick	100	J 5
Meacham Park	1,500	P 3
Meadville	446	F 3
Medill		J 2
Melbourne	102	E 2
Melrose	15	N 3
Memphis	2,035	H 2
Mendon	349	F 3
Mendota	2	G 1
Menfro	80	N 7
Mercer	377	F 2
Merwin	88	C 6
Meta	353	H 6
Metz	178	C 6
Mexico	11,623	J 4
Miami	217	F 4
Middle Grove	48	H 4
Middletown	240	J 4
Midridge	75	K 8
Milan	1,972	F 2
Milford	100	D 7
Mill Grove		E 2
Mill Spring		L 8
Millard	100	G 2
Millcreek	75	M 7
Miller	615	E 8
Millersburg	40	H 5
Millville	150	E 4
Milo	124	D 7
Mincy	6	F 9
Mindenmines	425	D 8
Mine La Motte		M 7
Mineola	75	J 5
Mineral Point	304	L 7
Mingo	200	M 9
Minnith		M 7
Mirabile	60	D 3
Missouri City	314	R 5
Moberly	13,115	G 4
Modena	95	E 2
Mokane	477	J 5
Moline Acres	99	*R 2
Molino	31	J 4
Monett	4,771	E 9
Monroe City	2,093	J 3
Montauk	20	J 8
Monterey		L 7
Montevallo	53	D 7
Montgomery City	1,679	K 5
Monticello	154	J 2
Montier	55	J 8
Montreal	83	G 7
Montrose	518	E 6
Montserrat	130	E 5
Moody	100	J 9
Mooresville	134	E 3
Mora	75	F 5
Morehouse	1,635	N 9
Morgan	55	G 7
Morley	494	N 8
Morrellton		K 6
Morrison	291	J 5
Morrisville	296	F 8
Morse Mill		L 6
Morton	16	E 4
Mosby	213	R 4
Moscow Mills	350	M 1
Moselle	130	M 4
Mound City	1,412	B 2
Moundville	168	C 7
Mount Leonard	142	F 4
Mount Moriah	260	E 2
Mount Vernon	2,057	E 8
Mount Washington		R 5
Mountain Grove	3,106	H 8
Mountain View	892	J 8
Munger		L 7
Murphy	160	O 4
Musselfork	19	G 3
Myrtle	95	K 9
Napier		B 2
Napoleon	143	E 4
Napton	80	F 4
Nashua		P 4
Nashville	50	D 8
Nauvoo	4	F 9
Naylor	520	L 9
Nebo	30	H 7
Neck	117	C 8
Neelys Landing		O 7
Neelyville	457	M 9
Nelson	297	F 4
Nelsonville		J 3
Nemo		F 7
Neola	3	E 7
Neosho	5,790	D 9
Netherlands	72	N 10
Nevada	8,009	D 7
New Bloomfield	400	J 5
New Boston	86	G 3
New Cambria	295	G 3
New Florence	522	K 5
New Frankfort	50	F 4
New Franklin	1,060	G 4
New Hamburg	156	O 8
New Hampton	375	D 2
New Hartford	38	K 4
New Haven	1,009	K 5
New Hope	175	L 4
New Liberty	10	K 9
New London	858	K 3
New Madrid	2,726	O 9
New Market		C 4
New Melle	150	M 2
New Offenburg	111	M 7
New Point	80	B 2
New Wells	48	N 7
Newark	156	H 2
Newburg	949	J 7
Newland	11	F 5
Newtonia	190	D 9
Newtown	231	F 2
Niangua	344	G 8
Nind	25	G 2
Nishnabotna	21	B 2
Nixa	509	F 8
Noble		G 9
Nodaway	65	C 3
Noel	685	D 9
Norborne	1,114	E 4
Normandy	2,306	P 3
North Fork	10	H 3
N. Kansas City	3,886	P 5
North Salem		G 3
Northmoor		P 5
Northview	200	G 8
Northwoods	1,602	*P 3
Northwye	99	J 7

* No room on map for name.

Norton		F 4
Norwood	315	H 8
Norwood Court	72	*P 3
Nottinghill	11	G 9
Novelty	188	H 2
Novinger	734	G 2
Oak		C 3
Oak Grove	761	S 6
Oak Hill		K 6
Oak Ridge	202	N 7
Oakland	15	G 7
Oakland	1,041	P 3
Oakside		J 8
Oakton	14	D 8
Oakville		P 4
Oakwood		K 3
Oasis		F 9
Ocie		G 9
Octa	20	M 10
Odessa	1,969	E 5
Oermann		L 6
O Fallon	789	N 2
Ohio	10	E 6
Olathe	20	H 8
Old Appleton	120	N 7
Old Monroe	268	N 1
Old Mines		L 6
Olden	61	J 9
Olean	165	G 6
Olivette	1,761	*P 3
Olney	93	K 4
Omaha	10	G 1
Ongo		G 9
Oran	1,156	N 8
Orchardfarm	50	O 2
Oregon	870	B 2
Orla	9	G 7
Oronogo	519	D 8
Orrick	675	O 5
Osa	15	E 9
Osage Beach	237	G 6
Osage City	250	H 5
Osborn	237	D 3
Osceola	1 082	E 6
Osgood	173	F 2
Oskaloosa	72	D 7
Otterville	414	G 5
Overland	11 566	P 3
Owensville	1,946	K 6
Owls Bend	75	K 8
Oxly	150	L 9
Oyer	12	E 7
Ozark	1,087	F 8
Pacific	1,985	N 4
Pagedale	3,866	*P 3
Palmer	60	L 7
Palmyra	2,295	J 3
Panama		D 6
Papinsville	55	D 6
Paradise	120	D 4
Paris	1,407	J 4
Parker		C 2
Parkville	1,186	O 5
Parma	1,163	N 9
Parnell	362	C 2
Pasadena Hills	1,102	*P 2
Pasadena Park	682	*P 2
Pascola	242	N 10
Passaic	75	D 6
Patterson	125	L 8
Patton	162	M 7
Pattonsburg	883	D 2
Pattonville	750	P 2
Paynesville		L 4
Peace Valley	68	J 9
Peach Orchard	59*	N 10
Peculiar	267	D 5
Peerless Park	119	O 3
Peers	25	K 5
Pennsboro	17	E 8
Pennville	18	F 2
Perkins	164	N 8
Perrin		D 3
Perry	813	J 4
Perryville	4,591	N 7
Pershing	36	J 5
Peruque	85	O 2
Pevely	416	M 6
Phelps City	139	A 2
Phenix		F 8
Philadelphia	200	J 3
Phillipsburg	170	G 7
Pickering	213	C 2
Piedmont	1,548	L 8
Pierce City	1,156	E 8
Pilot Grove	635	G 5
Pilot Knob	582	L 7
Pine	100	K 9
Pine Lawn	6,425	P 3
Pineville	464	D 9
Piney Park	21	*L 6
Pioneer	45	E 9
Piper	25	D 6
Pittsburg	56	F 7
Pittsville	56	E 5
Plad	30	G 7
Plato	100	H 8
Platte City	742	C 4
Platte Woods	159	*C 4
Plattsburg	1,655	D 3
Pleasant Gap	15	D 6
Pleasant Green	24	F 5
Pleasant Hill	2 200	D 5
Pleasant Hope	174	F 8
Plevna	120	H 3
Plymouth	35	E 3
Pocahontas	130	N 8
Point Pleasant	101	O 10
Polk		F 7
Pollock		F 2
Polo	549	D 3
Pomona	300	J 9
Pond	260	N 3
Ponder	9	L 9
Pontiac	37	G 9
Poplar Bluff	15 064	L 9
Portageville	2 662	N 10
Portage Des Sioux	264	P 2
Portia	5	D 7
Portland	200	J 5
Postoak	52	E 5
Potosi	2,359	L 7
Pottersville	25	H 9
Powe	95	M 9
Powersville	227	F 1
Poynor	40	L 9
Prairie Hill	124	G 3
Prairie Home	208	G 5
Prescott		J 8
Preston	109	F 7
Priceland	124	*E 6
Princeton	1,506	E 2
Prior	4	H 8
Proctor	2	G 6
Prosperine	7	G 7
Prospect Hill	4,000	R 2
Protem	60	G 9
Purcell	334	D 8
Purdin	255	F 3
Purdy	437	E 9
Pure Air	10	G 2
Purvis		G 6
Puxico	749	M 9
Quaker		L 7
Quarles	10	E 6
Queen City	554	H 2
Quincy	36	F 6
Quitman	135	C 2
Qulin	426	M 9
Racine	150	C 9
Racket	27	F 6
Racola		L 6
Rader		G 8
Rainey		E 7
Randles	169	N 8
Rat	3	K 8
Ravanna	132	E 2
Ravenwood	319	C 2
Rayborn		H 8
Raymondville	175	J 8
Raymore	208	D 5
Raytown	1,000	P 6
Rayville	193	E 4
Rea	110	C 2
Readsville	21	J 5
Red Bird	50	J 6
Red Oak	30	D 8
Redford	60	L 8
Redtop	50	F 7
Reeds	136	D 8
Reeds Spring	313	F 9
Reger	103	F 2
Renick	157	H 4
Rensselaer	63	J 3
Republic	965	E 8
Revere	180	J 2
Reynolds		K 8
Rhineland	198	J 5
Rhyse	25	J 7
Rich Fountain		J 6
Rich Hill	1 820	D 6
Richards	190	D 7
Richland	1,133	H 7
Richmond	4 299	D 4
Richmond Hts	15,045	P 3
Richwoods	250	L 6
Ridgedale		F 9
Ridgeway	560	D 2
Rinehart		D 7
Risco	495	N 9
Ritchey	137	D 9
Rivermines	485	L 7
Rives	166	M 10
Roanoke	65	G 4
Robertson	1,200	P 2
Robertsville	117	N 4
Roby	28	H 7
Rocheport	376	H 5
Rock Creek	35	O 4
Rock Hill	3,847	P 3
Rockbridge		H 9
Rockport	1,511	B 2
Rockville	372	D 6
Rocky Comfort	230	D 9
Rocky Mount	4	G 6
Rogersville	321	G 8
Rolla	9,354	J 7
Rombauer		M 9
Rome	25	G 9
Rosati	650	J 6
Roscoe	128	E 7
Rosebud	254	K 6
Rosendale	245	C 2
Rothville	152	F 3
Round Spring		J 8
Rover		J 9
Ruble	75	L 8
Ruegg	200	P 2
Rueter		G 9
Rush Hill	127	J 4
Rushville	319	B 3
Russ	50	G 7
Russellville	336	H 6
Rutledge	217	H 2
Sabula	60	L 8
Saco	75	M 8
Safe	25	J 6
Saginaw		C 8
Sagrada		F 6
Saint Albans	30	N 3
Saint Ann	4,557	P 3
Saint Anthony	30	H 6
Saint Catharine	80	G 3
Saint Charles	14 314	O 2
Saint Clair	1 779	L 6
Saint Elizabeth	59	H 6
St Francisville	275	J 2
Saint Francois	295	M 7
Saint George	642	H 8
Saint James	1,811	J 6
Saint Johns	2 499	P 2
Saint Joseph	78 588	C 3
Saint Louis	856,796	P 3
Saint Marys	635	M 7
Saint Patrick	53	J 2
Saint Paul	102	N 2
Saint Peters	377	N 2
Sainte Genevieve	3,992	M 6
Salem	3 611	J 7
Salem (Coffey)	253	D 2
Saline	25	E 1
Salisbury	1,676	G 4
Sammylane		F 9
Sampson	5	G 8
Sands		O 2
Sandstone		D 7
Sandyhook	57	G 5
Sank	6	N 8
Santa Fe	83	J 4
Santa Rosa		D 3
Santiago		F 6
Sappington	385	P 3
Sarcoxie	1,042	D 8
Sargent		H 8
Savannah	2,332	C 3
Saverton	150	K 3
Schell City	400	D 6
Schluersburg	30	N 3
Schuermann Heights	306	*P 3
Scopus		N 8
Seckman		P 4
Sedalia	20 354	F 5
Sedgewickville	92	N 7
Seligman		D 9
Senath	1 528	M 10
Seneca	1,195	C 9
Seventysix	14	N 7
Seymour	1,015	G 8
Shackleford	55	F 4
Shafter	10	F 3
Shamrock	23	J 4
Shelbina	2,113	H 3
Shelby	32	F 3
Shelbyville	635	H 3
Sheldon	427	D 7
Shell Knob	25	E 9
Sheridan	370	C 1
Sherman	225	O 3
Shirley		L 7
Shook	5	M 8
Shrewsbury	3 382	P 3
Sibley	200	O 5
Sidney	6	G 2
Sikeston	11,640	N 9
Silex	188	K 4
Siloam Springs		H 9
Silva	66	M 8
Silver Lake	53	M 7
Simmons	50	H 8
Skidmore	485	B 2
Slater	2 836	G 4
Sleeper	131	G 7
Sligo	35	K 7
Smallett	12	G 9
Smithfield	150	C 8
Smithton	339	F 5
Smithville	947	D 4
Sni Mills	25	S 6
Snyder	150	F 3
Solo		J 8
South Fork	20	J 9
South Gifford	128	G 3
South Gorin	303	H 2
South Greenfield	186	E 8
South Lineville	92	E 1
South West City	595	D 9
Spalding	25	J 3
Spanish Lake		P 2
Sparta	244	F 9
Spencerburg	35	K 4
Spickard	517	F 2
Splitlog	50	D 9
Spokane	55	F 9
Spoonerville	500	M 9
Sprague	29	D 6
Spring City	140	C 9
Spring Creek	85	J 7
Spring Fork	120	F 5
Spring Garden	46	H 6
Springfield	66 731	F 8
Springhill	28	E 3
Spruce	39	D 6
Spurgeon	25	C 9
Squires		G 9
Stahl	5	G 2
Stanberry	1,651	C 2
Standish	24	F 4
Stanton	250	K 6
Stark City	154	D 9
Steele	2,360	N 10
Steelville	1,157	K 7
Steffenville	75	J 3
Stella	177	D 9
Stet		E 4
Stewartsville	414	C 3
Stickney		J 6
Stockton	811	E 7
Stone Hill		K 7
Stotesbury	71	C 7
Stotts City	285	E 8
Stoutland	192	G 7
Stoutsville	146	J 3
Stover	693	G 6
Strafford	300	F 8
Strasburg	180	D 5
Strother		J 4
Sturdivant	103	M 8
Sturgeon	544	H 4
Sturges		E 3
Sublette		G 2
Success	45	H 8
Sudheimer		H 6
Sue City		H 3
Sugar Creek	1,858	R 5
Sugar Tree	16	E 4
Sullivan	3 019	K 6
Sulphur Springs	135	M 6
Summerfield	75	J 6
Summersville	306	J 8
Sumner	309	F 3
Sunnyvale	28	*D 9
Swart	1	C 7
Swedeborg	150	H 7
Sweden		H 9
Sweet Springs	1,439	F 5
Swinton	65	M 8
Swiss	21	K 5
Sycamore	44	H 9
Sycamore Hills	989	*P 3
Syracuse	221	G 5
Taberville	100	E 6
Taitsville	5	E 4
Tallapoosa		N 9
Taneyville	132	F 9
Tarkio	2,221	B 2
Tarsney		S 6
Tauria	25	F 9
Taylor	60	J 3
Tea	15	K 6
Tebbetts	150	J 5
Tecumseh	36	H 9
Ten Brook		P 4
Teresita	6	J 9
Thayer	1,639	J 9
Thomasville	70	J 9
Thompson	70	J 4
Thornfield	30	G 9
Tiff	75	L 6
Tiff City		C 9
Tiffin	100	E 7
Tigris	15	G 8
Tilsit	53	N 8
Timber	15	K 8
Tina	224	F 3
Tindall	102	E 2
Tipton	1,234	G 5
Tolona		J 2
Topaz	4	H 9
Torch	15	L 9
Toronto		G 6
Town and Country	162	*P 3
Townley	50	M 9
Tracy	201	C 4
Trenton	6 157	E 2
Trimble	141	D 4
Triplett	301	F 4
Troy	1,738	L 5
Truesdail	235	K 5
Truxton	125	K 4
Tunas		F 7
Turley		H 8
Turners		F 8
Turney	152	D 3
Turtle	28	K 7
Tuscumbia	221	H 6
Twin Bridges	22	H 9
Twin Oaks	81	*P 3
Tyler	150	N 10
Tyrone	45	J 8
Ulman	75	H 6
Union	2 917	L 6
Union Star	373	C 2
Uniontown		N 7
Unionville	2 050	G 2
University City	39 892	P 3
Uplands Park	563	*P 3
Upton		H 8
Urbana	359	F 7
Urbandale	35	G 4
Urich	400	E 6
Utica	475	E 3
Vale		R 6
Valles Mines	225	L 6
Valley City	30	E 5
Valley Park	2,956	O 3
Van	11	F 7
Van Buren	708	L 8
Vancleve		H 6
Vandalia	2,624	J 4
Vanduser	281	N 9
Vanzant	20	H 9
Velda	480	*P 3
Velda Village Hills	1,527	*P 3
Verona	396	E 9
Versailles	1,929	G 6
Vibbard	83	D 4
Viburnum	53	K 7
Vichy	150	J 6
Victoria	250	M 6
Vida	50	J 7
Vienna	471	H 6
Vigus	400	O 2
Villa Ridge	142	M 4
Vineland		L 6
Vinita Park	1,801	*P 3
Vinita Terrace	389	*P 3
Viola	20	E 9
Virginia	23	C 6
Vista		E 7
Vulcan	200	L 8
Waco	177	C 8
Wakenda	255	F 4
Waldron	95	O 5
Walker	204	D 7
Wallace		C 3
Walnut Grove	347	F 8
Wappapello	210	M 9
Wardell	454	N 10
Warren	25	J 3
Warrensburg	6 857	E 5
Warrenton	1 584	K 5
Warsaw	936	F 6
Warson Woods	529	*P 3
Washburn	250	E 9
Washington	6,850	K 5
Watkins	2	H 6
Watson	199	A 1
Waverly	809	E 4
Wayland	350	J 2
Wayne	84	E 9
Waynesville	1 010	H 7
Weatherby	156	D 3
Weaubleau	432	F 7
Webb City	6,919	C 8
Webster Groves	23,390	P 3
Weldon Spring		O 2
Wellington	649	E 4
Wellston	9 396	P 3
Wellsville	1,519	K 4
Wentworth	212	D 8
Wentzville	1,227	M 2
Wesco	100	K 7
West Line	68	C 5
West Eminence	144	J 8
West Fork	20	K 8
West Plains	4,918	J 9
Westalton	400	R 2
Westboro	297	B 1
Weston	1 067	C 4
Westphalia	319	J 6
Westville		G 3
Wheatland	299	F 7
Wheaton	394	E 9
Wheeling		F 3
Whiteoak	91	M 10
Whiteside	93	K 4
Whitesville		C 2
Whitewater	187	N 8
Whiting	125	O 9
Wilbur Park	743	*P 3
Wilcox	100	C 2
Wilderness	155	K 9
Willard	300	F 8
Willhoit		H 9
Williamsburg	95	J 5
Williamstown	158	J 2
Williamsville	492	L 9
Willmathsville	31	G 2
Willow Springs	1 914	H 9
Winchester		J 2
Winchester	176	*O 3
Windsor	2 429	E 5
Windyville	30	F 7
Winfield	474	L 5
Winigan	110	G 2
Winkler	11	J 7
Winnipeg	12	H 7
Winona	473	K 8
Winston	278	D 3
Wisdom		F 6
Wishart	90	F 7
Wittenberg	54	O 7
Wolf Island		O 9
Womack	40	M 7
Woodland	25	J 3
Woodlawn	50	H 3
Woodson Terrace	616	*P 3
Wooldridge	137	G 5
Worland	40	C 6
Worth	141	C 2
Worthington	186	G 2
Wright City	543	K 5
Wyaconda	483	J 2
Wyatt	345	O 9
Yancy Mills	6	J 7
Yarrow	45	G 2
Yates	39	G 4
Youngers		H 4
Yount		M 7
Yukon	15	J 8
Zalma	137	N 8
Zanoni		H 9
Zeta	35	N 9
Zion		M 8

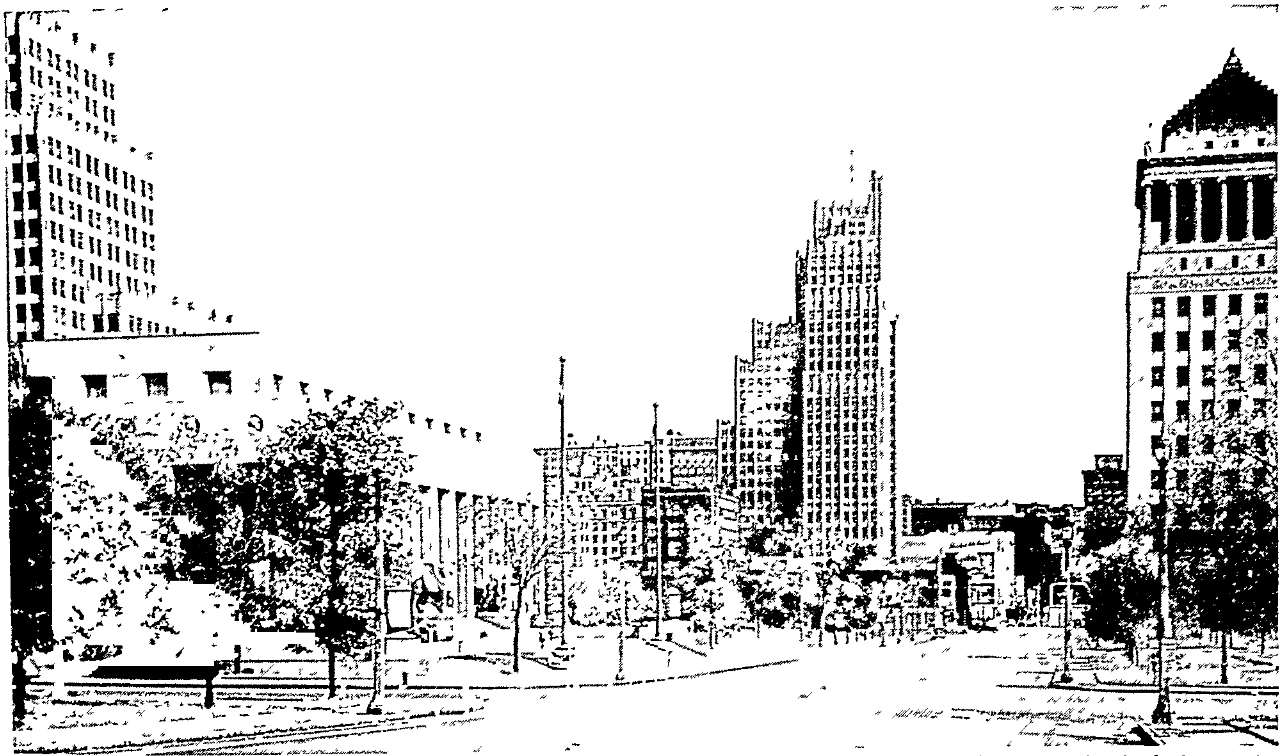
* No room on map for name.

A PICTURE TRIP THROUGH MISSOURI



1. Fine herds of cattle are familiar sights in all parts of the state. 2. The University of Missouri, chartered in 1839, at Columbia, is the oldest state university west of the Mississippi. 3. These hills, called "chat piles," are formed by waste from lead mines. 4. Stern wheelers with their barges plow the Missouri between St. Louis and Kansas City. 5. Mark Twain lived in this house at Hannibal. 6. Bagnell Dam on the Osage River has created the Lake of the Ozarks, 130 miles long.

MEMORIAL PLAZA IN DOWNTOWN ST. LOUIS



These buildings in landscaped surroundings bring beauty to the heart of the city. The building of modern classic design at the left is the Soldiers Memorial. Many fine civic buildings adjoin the park area. The Missouri Pacific Building rises above the Soldiers Memorial. The skyscraper in the center is the Telephone Building. The Civil Courts Building is at the right.

cult to work. Petroleum and natural gas occur in small quantities near the Kansas boundary.

Missouri ranks high as a manufacturing state because of abundant raw materials and its central location with good transportation by road, rail, and water. A network of railroads covers all the state except four counties in the south. A considerable tonnage of grain, coal, and other heavy freight is shipped by barges down the Mississippi.

Most of the manufacturing in the state is concentrated around the two largest cities, St. Louis and Kansas City (*see* St. Louis; Kansas City). Other industrial centers are St. Joseph, Springfield, and Joplin. The most valuable industry is the manufacture of food products. Livestock and farm crops from all over the state are shipped to the large cities for processing. Missouri ranks high among the states in the production of malt liquor. Other food industry products are packed meat, flour, and animal feeds.

The manufacture of automobiles and parts, clothing, and chemicals are other large state industries. Missouri is also a big producer of shoes.

Missouri's Universities and People

The state university is at Columbia, about 30 miles north of the capital. Washington University and St. Louis University are at St. Louis. The University of Kansas City is at Kansas City. Lincoln University, for Negroes, is located at Jefferson City.

Recent immigration has been slight. Only a very small part of the population is of foreign birth. The Ozarks are populated almost exclusively by descendants of the mountaineers of Kentucky and Tennessee. These people lived isolated and primitive lives until the discovery of mineral resources led to the development of this region.

Under Three Flags

Missouri, even when it was a wilderness, had a highway—the Mississippi—which has always been Missouri's great "through street." The Spaniard De Soto turned west from the "Father of Waters" in 1541 at Cape Girardeau and crossed the present state of Missouri. In 1682 La Salle came down the river and included the country in "Louisiana," which he claimed for the king of France. In the early 1700's lead was discovered in southeast Missouri. Peter Renault, a French pioneer, worked the lead mines with slaves until 1744. The first village was Sainte Genevieve on the Mississippi, where French settlers came in about 1735. The second settlement, St. Louis, began in 1764. To these two villages came many of the French settlers of Illinois after the English conquest.

France transferred this whole region to Spain in 1762. Many new settlers arrived from Kentucky and Tennessee by way of the Ohio River and its tributaries. They founded farms on the cheap lands of Missouri. Among them was the famous pioneer Daniel Boone (*see* Boone, Daniel). France got this whole country back in 1800 and sold it to the United States in 1803 (*see* Louisiana Purchase). To explore this new land, Lewis and Clark started up the Missouri from St. Louis in 1804 (*see* Lewis and Clark Expedition).

In 1811–12 earthquakes about New Madrid in the southeast opened great fissures in the earth, forming big lakes with water from the Mississippi River.

In 1818 Missouri asked Congress for permission to frame a constitution, prior to admission as a state. This request started a nation-wide controversy over the slavery question (*see* Missouri Compromise). Upon its admission as a state in 1821, the capital was established at St. Charles near St. Louis. Five years later it was moved to Jefferson City (*see* Jefferson City). At first the western boundary was the meridian line which still forms the boundary south of Kansas City. In 1837 the "Platte Purchase" added the land between that meridian and the Missouri River on the northwest. In 1821 Missouri sent David Barton and Thomas Hart Benton to Congress as its first senators. Benton, a typical Middle Western statesman, was a senator for 30 years (*see* Benton).

For many years St. Louis, then Independence, and lastly Kansas City were busy outfitting points for settlers moving westward. Hence Missouri was called the "Gateway to the West" (*see* Far West). Missouri troops under Col. A. W. Doniphan marched overland to the Southwest and helped win the war with Mexico (1846-48). Before the Civil War progress was made, largely with state aid, in building the Missouri-Pacific and other railroads.

Problems concerning slavery plagued the state until the Civil War. In 1855 groups of Missourians joined with Kansans in guerrilla warfare across the Kansas-Missouri border over the question of permitting slavery in Kansas (*see* Kansas-Nebraska Act). In 1861 a convention was called to "carry the state out of the Union." It surprised its promoters, however, by refusing to secede. Francis Preston Blair, Jr., a journalist and a strong antislavery leader, was largely responsible for the convention's action.

When the governor, Claiborne F. Jackson, tried to seize the arsenal at St. Louis, his plans were defeated by Capt. Nathaniel Lyon and a force of Unionists. Missouri was saved to the Union, but the people were about equally divided in sentiment. In 1861 Lyon defeated proslavery troops under Gen. Sterling Price, a former governor. Jesse James turned guerrilla after his family had been mistreated by Unionists, and later he became a notorious outlaw.

The constitution of 1945 provides for the initiative and referendum, as did its predecessor of 1875. (For additional history, *see* chronology in Missouri Fact Summary.)

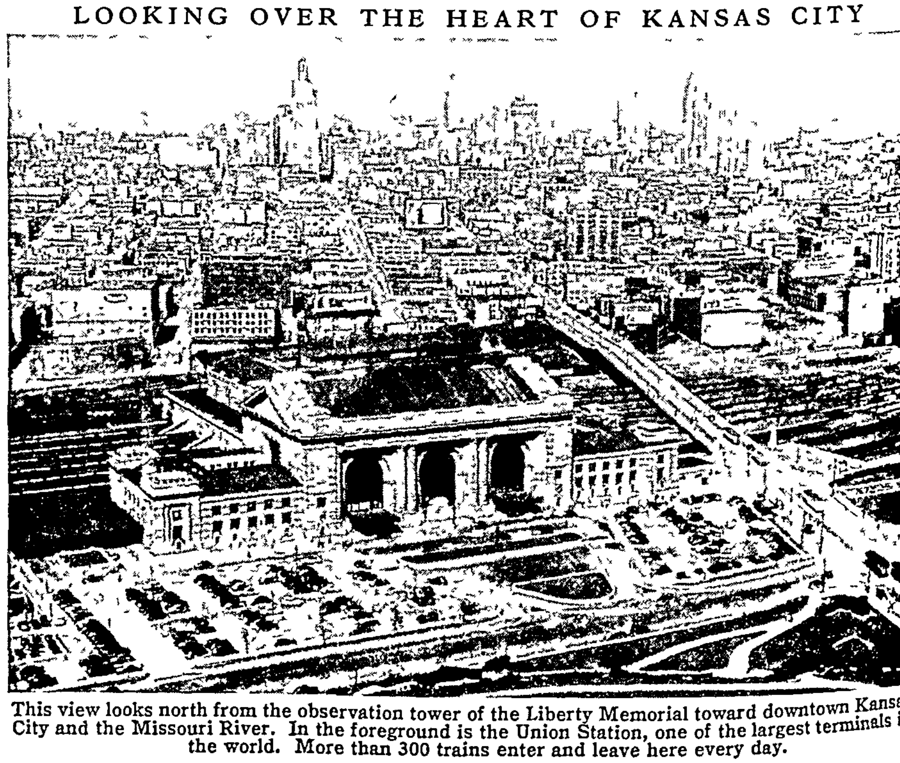
Noted persons born in Missouri include Harry S. Truman, the first president from that state, and Generals John J. Pershing and Enoch H. Crowder. Mark Twain was a happy-go-lucky boy in Hannibal. The poets Eugene Field and Sara Teasdale and the novelist Winston Churchill were also Missouri born. An "adopted son" was the Democratic party leader Champ Clark (a Kentuckian by birth), who represented Missouri in Congress for many years. (*See also* United States, section "North Central Plains.")

MISSOURI COMPROMISE. In February 1819 the people of the United States were awakened to the slavery issue as though a fire bell had rung in the night. Few had realized how sharply the North and South were divided over this question. The issue received little notice until a bill in the House of Representatives proposed to let Missouri draw up a constitution for statehood. Since slavery was already lawful in this territory, presumably Missouri would enter the Union as a slave state. Then James Tallmadge of New York introduced an amendment to the bill. He moved that no more slaves be brought into the new state and that all children born of slaves after its admission should be free at the age of 25.

Southern representatives expressed their alarm, while free state members were enthusiastic, although not unanimous, in approving Tallmadge's plan. For three days the House excitedly debated the question, then passed the amendment by a vote of 87 to 76.

For many reasons this inevitable struggle over the expansion of slave territory had been slow to appear.

LOOKING OVER THE HEART OF KANSAS CITY



This view looks north from the observation tower of the Liberty Memorial toward downtown Kansas City and the Missouri River. In the foreground is the Union Station, one of the largest terminals in the world. More than 300 trains enter and leave here every day.

The compromises of the Constitution on the subject had satisfied the slave states that the framers of that document intended no injustice against them. The importation of slaves was authorized until 1808; and Congress was required to provide for the return of slaves who escaped from one state to another. It chanced, also, that as far west as the Mississippi River a well-understood boundary line between slave states and free states had been established—in the East, Mason and Dixon's line (*see* Mason and Dixon's Line), and in the West the Ohio River (*see* Northwest Territory). Furthermore, in the admission of new states a balance had been kept between slave states and free states. There were then in the Union 11 of each. Thus, in the United States Senate, where each state had two members, the Senators from slave and free states were equal in number.

This balance of power proved useful to the South, for the Senate rejected the Tallmadge amendment. Missouri, however, clamored for admission, and the future boundary between slave and free states in the Louisiana Purchase required definition.

Terms of the Compromise

By the time the next Congress met the materials were at hand out of which to make a compromise. Maine, with the consent of Massachusetts, from which it now asked to be separated, was seeking admission as a free state. Also, Senator Jesse B. Thomas of Illinois had proposed that, with the exception of the state of Missouri, new slave states should not be created out of territory included in the Louisiana Purchase north of 36° 30′, the contemplated southern boundary of Missouri. At length both the House and the Senate agreed to permit Missouri to enter the Union as a slave state and Maine as a free state, and to accept for future guidance the dividing line that Senator Thomas had proposed (March 1820).

Some months later a supplementary Missouri Compromise had to be made. This was because the Missourians, who were for the most part strongly proslavery, had prepared a constitution which forbade the state legislature ever to pass a law emancipating slaves unless with the consent of their masters, and required the legislature to pass a law prohibiting the entrance of free colored persons into the state on any pretext whatever. The national House promptly voted against the admission of Missouri under this proposed constitution. Another compromise was arranged, however, mainly through the efforts of Henry Clay, by which Missouri was finally received into the Union on condition that her legislature would solemnly pledge itself never to ignore the rights of citizens of another state coming to Missouri (February 1821).

These compromises stilled the dispute temporarily, but after the Mexican War the addition of more territory to the west of the Louisiana Purchase revived the issue of slavery expansion. In 1854 the Kansas-Nebraska Act definitely repealed the provision that new slave states might not be created north of 36° 30′. (*See* Compromise of 1850; Kansas-Nebraska Act.)

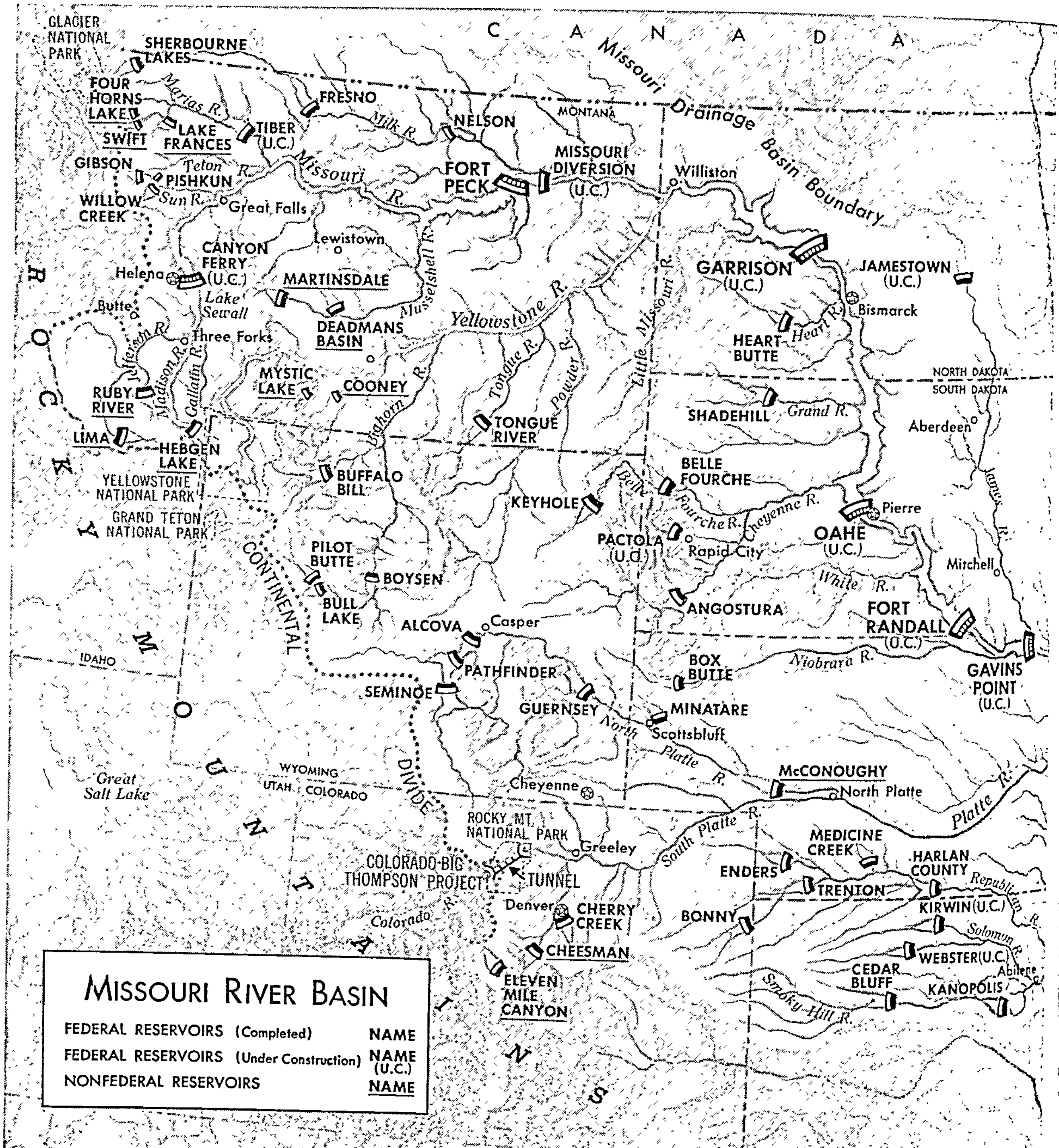
The MISSOURI—AMERICA'S *Mightiest* RIVER

To conserve water in the flat and arid Missouri basin the Bureau of Reclamation has built many dams such as Enders on Frenchman Creek in Nebraska.

MISSOURI RIVER. The longest river in North America is the Missouri. If the Missouri and Mississippi rivers had been explored at the same time, the Missouri would probably have been recognized as the main stream, flowing all the way into the Gulf of Mexico. The upper Mississippi—less than one half the Missouri's length—would then have been considered merely a tributary.

The headstream of the Missouri is the Red Rock River, which originates high up the slopes of the Rocky Mountains in southwestern Montana. From there to its junction with the Mississippi above St. Louis the Missouri is 2,714 miles long. Taken as one stream, the Missouri-Mississippi measures 3,872 miles from the source of the Red Rock to the Head of Passes at the Gulf of Mexico.

Coming down from the mountains the waters of the Red Rock flow into the Beaverhead and thence into the Jefferson. At Three Forks, Mont., 248 miles from its most distant source, the Missouri proper



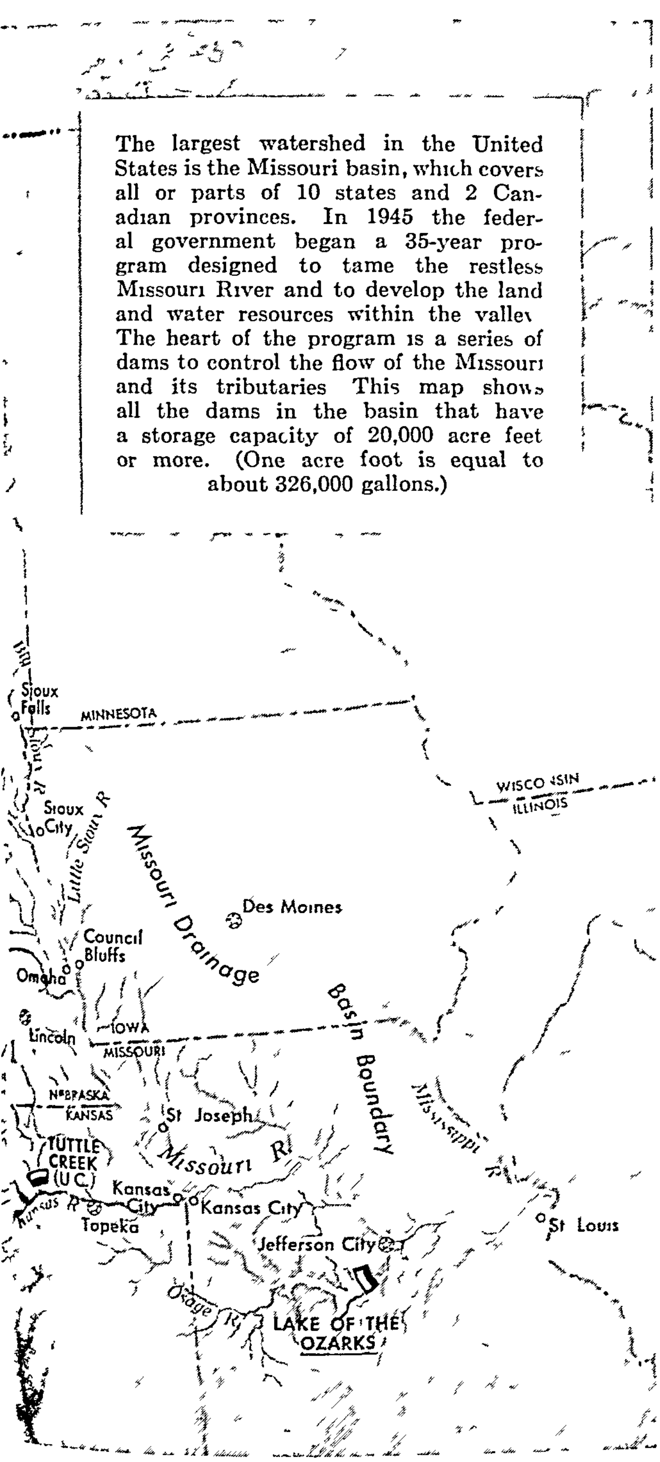
begins at the confluence of the Jefferson, Madison, and Gallatin rivers.

A Long and Restless River

In the early part of its course, the Missouri runs almost due north. Sixteen miles east of Helena, Mont., it flows through a narrow canyon with walls 1,200 feet high, called the Gates of the Mountains. Here the beauty and grandeur of the scenery are almost unequaled. Farther along are the Great Falls of the Missouri, where the river descends over 400 feet in 12 miles by a series of five cataracts, the highest having a fall of 75 feet.

Turning eastward the river broadens into the huge man-made lake of the Fort Peck Reservoir. After crossing into North Dakota the Missouri receives its biggest tributary, the Yellowstone. Near the center of North Dakota is the gigantic Garrison Dam which required ten years' construction time. Now flowing south and east the river enters South Dakota where it receives another major tributary, the Cheyenne.

At the Nebraska line the river forms part of the boundary between South Dakota and Nebraska, then forms the boundary between Nebraska and Iowa, Nebraska and Missouri, and Kansas and Missouri as far



The largest watershed in the United States is the Missouri basin, which covers all or parts of 10 states and 2 Canadian provinces. In 1945 the federal government began a 35-year program designed to tame the restless Missouri River and to develop the land and water resources within the valley. The heart of the program is a series of dams to control the flow of the Missouri and its tributaries. This map shows all the dams in the basin that have a storage capacity of 20,000 acre feet or more. (One acre foot is equal to about 326,000 gallons.)

as Kansas City. Along this stretch the Missouri receives two more big tributaries, the Platte in Nebraska and the Kansas (Kaw) at Kansas City. At this point the river enters Missouri and flows eastward until its reaches the Mississippi at Missouri Point, about 15 miles above St. Louis.

The Big Muddy and Its Basin

The Missouri is famous for its wild meanderings and its dangerous power. Largely frozen during the winter its discharge of water at the mouth has fallen as low as 4,200 cubic feet a second. In April the melted snow from the prairies overflows the river's banks, and in June more water is added from the melting snow in the Rocky Mountains. Until this water was partly controlled by the giant dam at Fork Peck the river might rise 30 feet and discharge 900,000 cubic feet of water a second at its mouth.

During flood times, the river cuts deeply into its earthen banks and carves out many changes of course. At other times, it tends to be clogged with silt, uprooted trees, and other snags. Through Montana the river runs clear but just inside North Dakota the Yellowstone carries in tons of silt from the brown, dry plains of Wyoming and Montana. As other prairie tributaries join, the river becomes more and more choked with silt until its color becomes a rich, deep brown. Each year the Big Muddy deposits more than 200 tons of soil at Missouri Point.

The drainage basin of the Missouri covers 529,000 square miles in the United States and 9,715 square miles in Canada. In industry and population, however, this huge area has lagged behind the development of the rest of the country. The valley has few manufacturing centers and only four cities of more than 100,000 population (Denver, Omaha, and the two Kansas Cities). There are only five other cities with more than 50,000 people—Lincoln, Topeka, Sioux City, St. Joseph, and Sioux Falls.

Although the Missouri basin covers one sixth the area of the United States, it has only 8 million people, one twentieth of the nation. From 1940 to 1950 when the national population increased 14.4 per cent, the population of the valley increased only 3 per cent. Over a longer span of time the trend has been the same. In 1910 the valley sent 64 members to Congress; today it sends only 51.

Harnessing the Big Muddy

Through the years many proposals have been made for taming the Missouri and developing the land and water resources of the valley. Finally in 1944 Congress adopted the Pick-Sloan plan for achieving these aims. It was named for its co-authors, W. Glenn Sloan of the Bureau of Reclamation in the Interior Department and Gen. Lewis A. Pick of the Army Corps of Engineers. The plan was a compromise between separate programs developed by these two agencies.

The multibillion-dollar-plan calls for the construction of 138 major power, irrigation, and flood-control projects by 1980. These projects are designed to supply about 3½ billion kilowatts of electric power a year and to irrigate about 10 million acres of farmland. Other features include the construction of levees along the lower river and a nine-foot navigation channel from Sioux City to the mouth of the river.

The variety of needs to be served make planning difficult and controversial. For example, in times of drought, extra water would have to be released from reservoirs to maintain the downstream navigation channel. At the same time farmers upstream might need the same water for irrigation. In addition, the release of water for these purposes might reduce the amount available for generating electricity.

To co-ordinate the work of the various agencies involved in the project the Missouri Basin Inter-Agency Committee was formed in 1945. It includes representatives from the Army Corps of Engineers, the Departments of Interior, Agriculture, and Commerce, the Federal Power Commission, the Public Health Service and the governors from the ten states in the basin.

Critics have said that the Pick-Sloan plan is inefficient, wasteful, and without overall direction. Some have advocated a strong federal agency patterned after the Tennessee Valley Authority to direct the entire program. In 1953 a president-appointed commission recommended unanimously that there should be one central organization with power to coordinate all the valley's development projects.

Across the Wide Missouri

Marquette and Joliet discovered the mouth of the Missouri as they came down the Mississippi in 1673. In the next century, French fur traders began to make their way along its turbid waters in canoes and primitive boats. By 1705 they had pushed as far westward as the mouth of the Kansas River. Probably none of them went farther upstream than the mouth of the Platte, which was considered to be the dividing line between the upper and lower river.

A TRADITIONAL CHRISTMAS DECORATION

The mistletoe is a parasitic shrub that grows on the trunks of other trees. According to tradition, a person caught under the mistletoe must give up a kiss.

Étienne Veniard de Bourgmont was one of the first careful explorers of the Missouri. As early as 1714 he reached the mouth of the Platte, making detailed notes on what he had seen along the lower river. Nine years later he established Fort Orleans on the river in north central Missouri.

In 1804–5 Capt. Meriwether Lewis and William Clark, under orders from President Jefferson, explored the full length of the Missouri to its source. They gave the first accurate account of its entire course (*see* Lewis and Clark Expedition). In 1819 the first steamboat operated on the river. In the middle of that century settlers bound for Oregon and California found the river their last link with civilization. They steamed up its waters to Independence or St. Joseph before beginning their overland trek through the Missouri basin, or Great American Desert, as the region was called on some early maps. For years the settlers hurried across the uninviting watershed to the greener pastures of the Pacific coast.

When farmers and ranchers did settle in the basin they had to face natural hazards that still exist today —lack of adequate rainfall, severe droughts, floods, and soil erosion. Most of these hazards can and will be overcome when the turbulent Missouri River has been harnessed to work for the people of the valley instead of against them.

MISTLETOE. Do you know that this familiar Christmas decoration, with its waxen white berries and glossy evergreen leaves, never takes root in the ground? It is a parasite that grows from a "sucker root" on the trunks of other trees. It belongs to a genus of which there are about 20 species, all parasitic, distributed through the warmer parts of the Old World. Of these only the mistletoe proper (*Viscum album*) is a native of Europe. The American mistletoe (*Phoradendron flavescens*) grows from New Jersey southward and westward and closely resembles the European in general appearance.

The mistletoe appears as a bushy growth with many forking branches, often four feet long. It has oval leaves and tiny yellow blossoms, followed by the little white berries that ripen after the first snow falls. It grows on both deciduous and evergreen trees. The poplar, willow, mountain ash, and maple are among its favorites. In England it grows in greatest abundance on the apple tree. It is rarely found on the oak. The birds eat the pulpy berries. Flying from tree to tree, they carry the seeds, which lodge in the bark and grow.

Because of its peculiar character the mistletoe played a prominent part in German and Norse mythology, and it was with an arrow from its wood that the beautiful god Balder was slain (*see* Balder). The mistletoe was said to bring happiness, safety, and good fortune so long as it did not touch the ground. Perhaps this is the reason why today we always hang up our mistletoe in the window or on the chandelier. The Celts held the plant in veneration, especially when found on the oak.

MITCHELL, GENERAL WILLIAM L. (1879–1936). One of the most accurate military prophets of the 20th century was Gen. William L. Mitchell. As early as 1921 he predicted that air supremacy would win the next war. In 1925, he was court-martialed for insubordination. But the second World War confirmed Mitchell's theories on air power. In 1942, six years after his death, Congress restored his name to the army rolls with the rank of major general.

PROPHET OF AIR POWER

General "Billy" Mitchell was one of the first to forecast the importance of military airplanes in modern warfare.

"Billy" Mitchell was born in France in 1879. When he was three his parents returned to their family estate near Milwaukee. His father, John, later became a senator from Wisconsin. Young Mitchell was an outstanding athlete while attending private schools in Milwaukee and at Racine College. In 1895 he entered George Washington University. When the United States declared war on Spain, Mitchell enlisted in the army as a private. He quickly advanced to the rank of second lieutenant in the Signal Corps. After the war he remained on duty with the army.

Mitchell became interested in flying when he witnessed the Wright brothers' first demonstration of a military plane at Fort Meyer in 1908. Six years later Orville Wright taught him to fly. In 1917, Mitchell organized and later commanded the United States air force in France. He was made a brigadier general.

Following the armistice, Mitchell became assistant chief of the Air Service. In 1921 he proved that bombers could sink even the largest naval vessels of that time. He constantly criticized the military high command for not developing American air power. As a result he was reduced to the rank of colonel. When a navy dirigible was lost in 1925, Mitchell charged high officers with "criminal negligence." His court martial for insubordination followed. Rather than accept a five-year suspension from the army, Mitchell resigned. As a private citizen he continued his appeal for adequate air power. He died in 1936 of a heart ailment.

MITSCHER, ADMIRAL MARC ANDREW (1887–1947). Early in the second World War the United States carrier *Hornet* plowed to within 800 miles of Japan. From its flight deck 16 medium bombers zoomed into the air for the first attack on Tokyo. Watching the take-off from the bridge of the *Hornet* was a seemingly mild little man. His wrinkled face and anxious eyes were sheltered by a long-visored baseball cap. He was Rear Admiral (later Admiral) Marc Mitscher, the leader who made Task Force 58 the most powerful aerial striking force in naval history.

Standing five feet six inches high, Mitscher directed his huge carriers in a half-whisper. He always sat in one corner of the bridge even during a Japanese air attack. An example of his care for his men came after the Americans won the battle of the Philippine Sea. At nightfall many of his aircraft had not returned. To guide his pilots back to their carriers Mitscher ordered lights on, despite strict blackout regulations. This action saved the lives of 68 men.

AMERICAN NAVAL LEADER

Admiral Marc Mitscher's hard-hitting airplane carrier force made daring use of naval air power in the Pacific during the second World War.

Marc Mitscher was born in Hillsboro, Wis. When he was two years old his father became an Indian agent in Oklahoma. Later the family moved to Washington, D. C. Young Mitscher wanted to be an army officer but accepted an appointment to the Naval Academy instead. He was graduated from there in 1910. After five years of sea duty he won a navy pilot's wings.

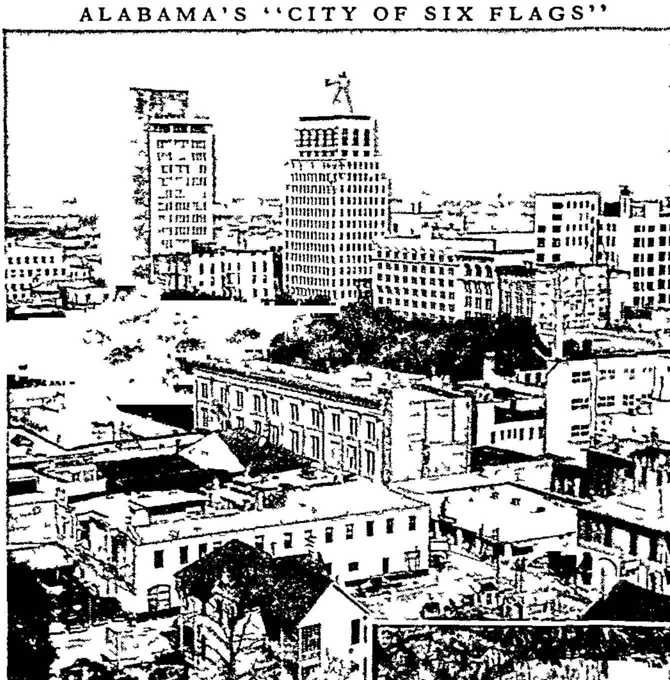
Just three days before the attack on Pearl Harbor he was promoted to rear admiral. After the Tokyo raid he commanded the *Hornet* in the battle of Midway (*see* World War, Second). The tough little skipper then commanded the air phase of the Solomon Islands campaign. Here his sure, quick decisions doomed 500 Japanese planes.

In 1944 and 1945 Mitscher's speedy Task Force 58 spearheaded the United States drive across the Central Pacific. His deadly air assaults smashed at the enemy from the Marshall Islands to the Philippines and then northward into Japanese home waters. After the war, Mitscher was promoted to full admiral and made commander of the Atlantic Fleet.

MOBILE, ALA. The second city of Alabama and its only seaport, "the City of Six Flags"—as Mobile is called—has had a long romantic history. It was founded in 1702 by the French at a point north of the

present city, and was the capital of the French province of Louisiana until 1720. In 1763 it was ceded to the English, but in 1780 the Spanish captured it. In 1813, under the claim that Mobile was part of the Louisiana Territory sold by France to the United States in 1803, it was seized for the United States by Gen. James Wilkinson. It flew the flag of the Republic of Alabama just after secession and then the Confederate flag almost to the end of the Civil War. Although Admiral Farragut captured the Confederate fleet and forts guarding the bay in August 1864, Mobile was not taken until April 1865.

ALABAMA'S "CITY OF SIX FLAGS"



At the top is the business center of Mobile. Bienville Park, with its beautiful live oaks, nestles among the buildings. At the bottom are the famous Bellingrath Gardens, south of the city. Their lavish floral displays attract visitors the year round.

Beautiful old Spanish and French homes, many with "iron lace" trim, give the city an old-world atmosphere. In early spring thousands of visitors make the 22-mile tour of its public and private gardens, known as the Azalea Trail. The azalea was first planted in Mobile by Fifise Langlois in 1711. He brought the flower from his native Toulouse. When the azaleas and camellias are in bloom, Mobile is a scene of brilliant color and spectacular beauty. The Bellingrath Gardens, about 20 miles south of the city, are internationally famous.

Mobile lies on a wide sandy plain which rises gradually from a low water front along the Mobile River to a range of hills to the west. The harbor in the mouth of the river and the channel through Mobile Bay to the Gulf of Mexico, 36 miles distant, have been widened and deepened to allow the passage of the largest ships. Imports include bauxite and manganese ores, petroleum, bananas, and sugar. Lumber, cotton, iron, and steel are the leading exports.

The Alabama State Docks here are among the largest public docks in the nation. Shipbuilding, for years a big industry, expanded greatly during the second World War. Most of the city's large industries are along the river banks. These include a giant plant which extracts aluminum from Guiana bauxite, and many mills making pulpwood, paper, paper products, textiles, and cement. Brookley Air Force Base, south of the city, has its own dock facilities. The Bankhead Tunnel under the Mobile River shortens the approach to the city. Population (1950 census),129,009.

MOCCASIN SNAKE. Along the banks of streams or on the edges of swamps throughout the southern United States may be found the water moccasin, one of America's most poisonous snakes. Mostly it lies upon some old log or overhanging branch watching the water, and if some unfortunate fish or frog passes beneath its sentinel post the moccasin drops upon it like a flash. If the victim escapes the first rush, the snake will pursue it with superior swiftness far beneath the surface, returning to land to swallow its meal.

The moccasin's body is thick and heavy, with a quickly tapering tail. In color, it is dark brown with obscure black marks on its sides and yellowish spots on throat and abdomen. It will flee rapidly at the approach of man. But if cornered it will fight savagely, striking out with wide open jaws and displaying the white gullet which has given it the nickname cottonmouth. It is chiefly dangerous when it invades flooded rice fields.

With the copperhead and the rattlesnake, the moccasin belongs to the pit viper family of snakes (*see* Copperhead; Rattlesnake; Vipers). Its young are born alive, usually eight to ten in number. The scientific name of the moccasin is *Agkistrodon piscivorus*.

MOCKINGBIRD. In the Southern states, between the months of February and August, the mockingbird sings both day and night. What the nightingale is to Europe, the "mocker" is to the South. On moonlight nights one singer begins its serenade; soon others join, until the chorus has awakened the other birds, who add a few notes of their own songs before falling asleep again.

Besides its natural song, the mockingbird imitates the notes of many other birds. It acquires this skill by practice and it is a most exacting self-teacher—

going over the songs again and again, until it is able to deceive an attentive listener. It even imitates the barking of a dog and other unmusical sounds.

The bird is about 10½ inches long. It is ashy gray above, paler below, with conspicuous white wing patches. The long, rounded tail is edged with white. (For picture in color, *see* Birds.)

Mockingbirds have many endearing traits. They are very courageous and in defense of their young will attack dogs, cats, or even man. If they are encouraged with food and a bird bath, they will build in the shrubbery about the doorway of a house, perching sociably upon the window ledge or even venturing inside. The nest is usually within ten feet of the ground and is made of grass, sticks, or any convenient material. The four greenish-blue eggs are spotted with brown (for picture in color, *see* Egg).

The mockingbird belongs to the family of "mimic thrushes" (*Mimidae*), which includes the catbird and the thrashers. In the United States it is represented by the eastern mockingbird, which breeds in the southeastern states from the Gulf coast and Florida north to Iowa and Maryland, and by the western mockingbird, in the southwestern states. It is the state bird of Arkansas, Florida, Mississippi, Tennessee, and Texas. The scientific name is *Mimus polyglottos.*

The MOHAMMEDAN RELIGION *and Its* FOUNDER

MOHAMMED (570-632) AND MOHAMMEDANISM, OR ISLAM. A lowly Arab camel driver in his orphaned boyhood, Mohammed became the founder of one of the world's great religions and the spiritual and political leader of his people. Today more than 300 million followers revere him as the prophet of God, whom they call Allah. Europeans call his religion Mohammedanism. He called it Islam, meaning "submission to the will of God." A believer is a Moslem, "one who submits."

Born in Mecca into the strong Quraysh tribe, Mohammed became an orphan early in life and was reared by his grandfather and uncle. As a camel driver he accompanied caravans from Mecca to surrounding countries. He thought seriously upon all that he saw and heard in the desert and in the cities. The matter that caused him deepest concern was the ignorance and superstition of the Arabs, who worshiped idols.

Marrying the rich widow Khadija, at 25 years of age, he became a successful merchant, but he continued to brood about the low moral condition of his people. At this time Judaism and Christianity flourished in some Arabian communities. He was familiar with these faiths and contrasted them with the idolatry of the Arabs. He became convinced that there was but one true God, Allah, and not a multitude of magic-working spirits (like the genie of Aladdin's lamp) who dwelt in sticks and stones and graven images.

He was 40 when he announced that God had chosen him through the angel Gabriel to preach and spread Islam. He declared himself to be the last of the prophets. He recognized Adam, Noah, Abraham, Ishmael, Moses, Jesus, and others in the Bible as earlier prophets. As he made known the messages from God, revealed in Gabriel's appearances to him, his followers wrote them down. They were incorporated into the Koran, the holy scriptures of Islam (*see* Koran).

Khadija was his first convert. She encouraged him to preach the new faith openly. Many Meccans were hostile because their prosperity was largely dependent upon the pilgrims who visited the shrines of their idols. They persecuted the prophet and his band of believers.

Finally he had to flee to the neighboring city of Medina. Some of his followers accompanied him and others took refuge with the Christian Abyssinians in Africa. Mohammed's flight, or "Hegira" (A.D. 622), was the turning point in his career. It is the date from which the Moslem world reckons time, as Christians do from the birth of Christ.

He had been invited to Medina to restore order between warring tribes. He became the city's ruler and military commander, and he organized his followers into a strongly disciplined military force. They defended the city against attacks by the Meccans and other enemies. They moved against hostile tribes, taking booty and exacting tribute. Mecca fell with little resistance in the eighth year after his exile. Mohammed destroyed the idols and made the ancient

LEARNING TO READ THE KORAN

This Afghanistan lad, like all boys of the Moslem world, will know the teachings of his faith as soon as he can read, for the Koran is his textbook. If he learns the whole book by heart his village will celebrate to honor him and his teacher.

Kaaba shrine the sanctuary of Allah (*see* Mecca). Now one tribe after another offered voluntary submission. At Mohammed's death in A.D. 632, all Arabia was united under Islam, and an inspired army stood ready to carry out his dream of spreading the faith to all the world.

Essentials of the Moslem Religion

The doctrine of Islam is based on the Koran and the *Sunna*, or traditions. The latter is the sayings and deeds of Mohammed as collected after his death by Moslem leaders. The five duties of a believer, sometimes called the five pillars of Islam, are:

1. Recital of the Creed. In its shortest form the creed is: "I testify that there is no god but Allah, and that Mohammed is the apostle of Allah." Acceptance of the creed implies belief in God; the angels; the inspired books; the prophets; the day of judgment; and God's predestination of good and evil. The latter is the basis of the fatalistic attitude of the Moslem. When anything happens he says: "It is the will of Allah."

2. Prayer. The Moslem worships five times a day, facing Mecca. The phrases of his prayers and the postures of his body are prescribed. Worship is preceded by ceremonial bathing. In the desert, clean sand may be used instead of water. On Friday, the Moslem holy day, prayers and a short sermon are held in the house of worship, the mosque. The leader is called the *imam*.

3. Fasting. In the month of Ramadhan, "wherein the Koran was revealed," the faithful fast. They do not eat or drink between dawn and sunset.

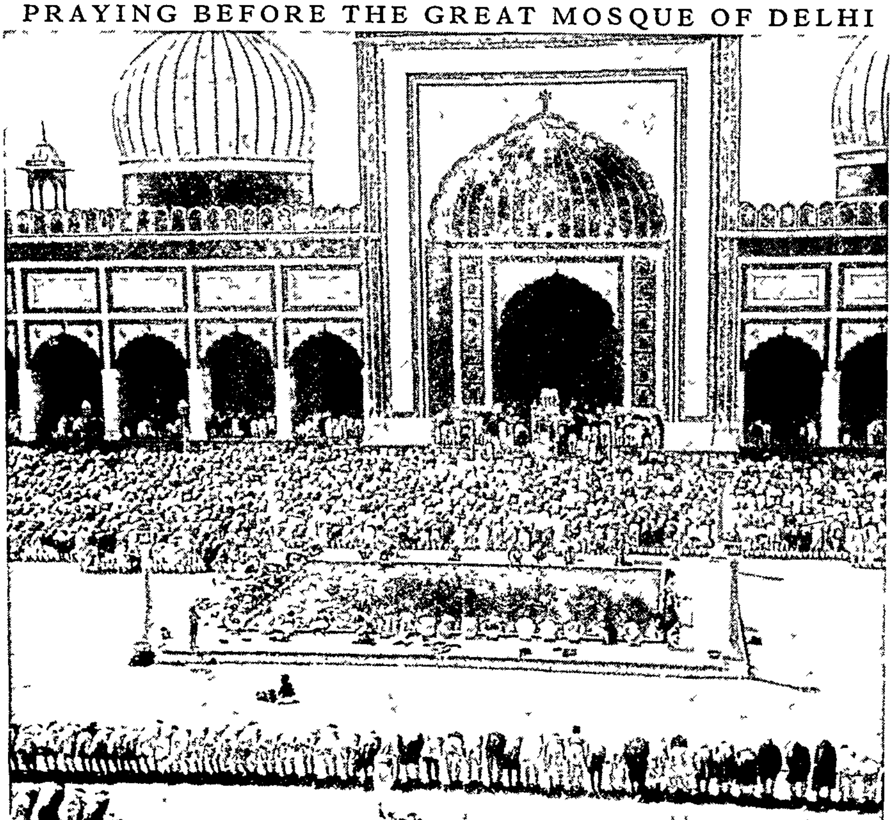
4. Almsgiving. All believers are expected to give alms to assist needy fellow-Moslems. In some Moslem countries a poor tax is collected.

5. The Pilgrimage to Mecca. All Moslems who are physically and financially able are expected to make a pilgrimage to Mecca, the holy city, at least once in their lifetime.

Islam has no organized church, no priest, and no sacrament. Moslems believe that the prophet transmitted the will of God to mankind and that the individual stands alone in direct relationship with God, surrendering himself (*aslama*) to His mercy.

Many Mohammedan customs were patterned after those prevailing in the East. Polygamy, then widely practiced, was adopted. Mohammed limited the number of wives to four and enjoined men to take only one wife if they could not provide for more. The lowly position of Oriental women was improved under Islam. They can possess property, inherit it, and divorce their husbands under certain conditions. The Koran does not stipulate that women wear veils and live in separate apartments from the men of their families. These customs, however, grew up in Moslem lands. Mohammed condemned slavery and regarded freeing a slave as a virtuous act. Eating pork was forbidden, as among Jews, and wine drinking was prohibited.

PRAYING BEFORE THE GREAT MOSQUE OF DELHI



Here hundreds of Indian Moslems pray at Friday noon services. They face the arched doorway, which marks the direction of Mecca. In the center is the tank where they do the ceremonial bathing required before worship. The dome and colonnades are typical of Moslem architecture.

Islam as a State

Islam is a social and political order as well as a religion. It developed logically from the ancient tribal structure in Arabia, founded upon blood kinship. The deep-seated instincts of brotherhood and equality in the tribe were extended by Mohammed to include the faithful of every race and color. The Moslems became "a single hand, like a compact wall whose bricks support each other." Whoever entered into the community (*ummah*) became bound in mutual help and "entrusted with the furtherance of Good and repression of Evil." Today Moslems live in many nations, but the religious tie among them is usually stronger than their national sentiments. The emphasis on love in Christianity is paralleled by that on equality and brotherhood found in Mohammedanism.

Since Mohammed died without a successor, conflict arose over who should be the new leader (caliph). The first four were Meccans who had been closely associated with the prophet: Abu Bakr, father of his favorite wife, Ayesha; Omar; Othman; and Ali, his cousin and the husband of his daughter, Fatima. Later caliphs lived in lands outside Arabia to which Islam spread. The caliphate came to an end in 1258 when the Mongols captured Baghdad, the last seat of the caliphate.

Islam is divided into two major sects, and these in turn are split into schools, each with its own special beliefs. Most Moslems are *Sunnites*, so called from their belief in the *Sunna*. Opposed are the *Shiites*, who hold that Ali, Mohammed's blood relative, was his only rightful successor. They reject the Sunna, because other caliphs had a part in its formation.

FACING TOWARD MECCA

Wherever they are, all good Mohammedans stop their activities five times a day to pray. They may be in the desert, like these two Egyptians, or they may be in a busy city. But at those times they face toward the holy city of Mecca and repeat the prayers of the faithful. The prayers testify that Allah is the only god and that Mohammed is his prophet.

Conquests and Culture of Islam

Within a hundred years after Mohammed's death, Persia, Iraq, Palestine, Syria, Egypt, northern Africa, and Spain had fallen before the victorious caliphs. Later the Saracens, as the Moslem troops were called, pushed westward into Turkey and eastern Europe and eastward into Afghanistan, India, and southern Russia. Merchants and adventurers spread the faith in central and southeastern Asia and interior Africa. Advancement in western Europe, however, was halted at the battle of Tours in 732 by Charles Martel, grandfather of Charlemagne. Driven back into Spain on the west and held in check by the Byzantine Empire at Constantinople, the Arabs, Moors, and other Mohammedan peoples settled down in their new-won lands and developed a culture which far surpassed the contemporary culture of western Europe.

The centers of this culture were Damascus, in Syria; Baghdad, on the river Tigris; Cairo, on the lower Nile; and Córdova, in Spain. Here were gathered together the threads of civilization drawn from Greece, Persia, Syria, Egypt, India, and Spain. Agriculture made great strides. Irrigation was practised extensively and tree-grafting became a science. Among new plants introduced into Europe from the Arabs—especially during the crusades—were rice, sugar cane, hemp, artichokes, asparagus, the mulberry, orange, lemon, and apricot.

In manufactures the Saracens excelled. The sword blades of Toledo and Damascus were world renowned. Equal skill was shown in the fashioning of vases, lamps, and like articles of copper, bronze, and silver; in the weaving of carpets and rugs which are still unsurpassed; in the molding of fine glass and pottery. Sweetmeats, syrups, essences, and perfumes were produced. Paper, without which the invention of printing would have been valueless, came to Europe through the Mohammedans. The finest leather goods came from Córdova and Morocco.

Arab caravans threaded their way into central Africa, and across the wilds of Asia to China and India to fetch the riches of these far-off lands, and Arab ships distributed them in the Mediterranean.

In literature, particularly poetry, and in science the Mohammedans attained a high degree of development. The University of Cairo at one time had 12,000 students. In Spain in the 10th century a library of 400,000 manuscripts is said to have been collected. Learned Arabs did much to preserve and spread broadcast the writings of the great Greek philosopher Aristotle, after he had been all but forgotten in western Europe. In mathematics Mohammedan scholars led the world. Algebra was practically their creation, though its elements were derived from the Greeks and the Hindus. The so-called Arabic numerals were introduced by them and replaced the clumsy Roman numerals. In astronomy they made notable advances. In chemistry many of our common terms, such as "elixir," "alcohol," "alkali," which are of Arabic origin, prove our indebtedness to these early students. In medicine their skill was in advance of European physicians, and they virtually laid the foundation of scientific

pharmacy. Many of their preparations are still in use. The richness and grace of their architecture are evident today, especially in Moorish Spain. Byzantine civilization alone was the equal of Islam's. Christians fighting to regain the Holy Land carried new ideas and products to Europe (*see* Crusades).

Moslem culture began to wane in the 11th century when the Islamic world was split by the rise of Turkish power. For centuries the golden era of art and learning was but a memory. Recent decades have witnessed an awakening in Islam. It holds an important position in world political affairs (*see* Islam).

MOLE. The mole spends its entire life in darkness. It lives in an underground burrow and tunnels through the earth to find its food of earthworms. A long ridge of earth that zigzags across lawn and field is probably the roof of a mole's tunnel. The only way to see the animal is to dig into the tunnel. The mole is about six inches long, with a naked, pink tail about an inch long, and dense, velvety, mouse-colored fur. It has a long, piglike snout, and a short, thick neck. The ears are little openings concealed in the fur. The dim eyes are tiny points covered with skin. The spadelike front feet are armed with five long, sharp claws and turned outward.

If you put the creature on the ground, it scrambles about frantically until it finds a soft spot. Then it begins to dig, and in less than one minute it has disappeared. The mole "swims" through the soil with a powerful breast stroke in which the forefeet thrust forward and then out to the side, pushing back the soil. The snout and tail are sensitive organs of touch and help to guide it through the darkness.

Moles disfigure lawns, pastures, and gardens by the ridges they make. They pay for some of the damage by eating quantities of cutworms and other root-destroying pests, but their chief food is earthworms.

The mole makes a nest of leaves and grasses in a small chamber ten inches or more below the surface of the ground. It is usually located under a boulder, tree stump, bush, stone wall, or other surface obstacle which gives it added protection. From the nest radiate runways. Some are so close to the surface that the roof is seen as a ridge above ground. From deep tunnels the mole gets rid of the excavated earth by pushing it up a short "chimney" to the surface where it piles up in the familiar molehill.

Two to five young are born in early spring. There is only one litter a year. The young are blind and naked at birth, but have a velvety covering of light gray fur by the time they are ten days old. They grow rapidly and are able to leave the nest and take care of themselves in about four weeks. They are mature and able to bear young the following spring. Moles remain active all winter and do not hibernate.

The star-nosed mole is the most remarkable looking member of the family. It has 22 fleshy pink projections, which fringe the tip of the snout. It lives in eastern North America, in the black muck of swamps, or in the borders of slow-moving meadow streams. It is an expert swimmer.

STAR-NOSED AND COMMON MOLES

The star-nosed mole (top) is a little larger than the common mole (bottom). It is remarkable for the 22 fleshy growths around the snout. Notice the spadelike feet of the common mole and the wedge-shaped head, adapted for pushing through the earth.

Moleskins are used in the fur trade for trimmings and capes. Practically all the skins are imported from Great Britain and northern Europe.

Moles are found throughout the northern half of the world. They belong to the family *Talpidae* of the insect-eating order of mammals, the *Insectivora*. They are closely related to the shrews (*see* Shrew). The common eastern mole is *Scalopus aquaticus;* the western mole is *Scapanus townsendi;* the star-nosed mole is *Condylura cristata*.

MOLIÈRE (*mô-lyĕr'*) (JEAN-BAPTISTE POQUELIN, 1622–1673). What Shakespeare was to English literature, Molière was to French literature. He is not as broad and deep as Shakespeare in his view of human life or as full of poetry. However, no modern dramatist has equaled him in the comedy of manners—that form of comedy in which one laughs at the fashions and foibles of his time. Though he portrays his own countrymen and his own age, Molière like Shakespeare belongs to all lands and all ages. Today, after some three centuries, his plays still continue to delight great audiences, as they did in the days of his patron the Grand Monarch, Louis XIV.

Jean-Baptiste Poquelin—for that was his real name, and "Molière" only an assumed one—was born in Paris, the son of a prosperous furniture maker who held the office of upholsterer to the king. Instead of following his father's calling or taking up the practise of law, for which he had been educated, the young man chose the uncertain life of a strolling player, and it was at that time that he took the stage name Molière. As an actor and theatrical manager, he learned the art of the stage and gained that perfect mastery of dramatic structure for which his plays are noted. He also learned to know human nature and especially did he search out the weaknesses, the follies, the vanities and pretensions, the ludicrous traits in men and women. He usually emphasizes one outstanding characteristic. Harpagon in 'L'Avare' (The Miser) and the hypocrite 'Tartuffe' are immortal creations of his genius; and few characters have aroused the world's laughter as Monsieur Jourdain in 'Le Bourgeois gentilhomme'. His satire spared no class or profession in exposing the bigotry and pretensions of society in his day.

The last play Molière wrote was 'Le Malade imaginaire' (The Imaginary Invalid), and in this he himself played the leading part, that of the invalid Argan. Though the character was suffering only from an imaginary disease, the actor himself was really very ill. In the midst of the play he fell into a violent fit of coughing and died a half hour after the performance. It was Molière's last jest.

Molière's chief works are: 'L'Etourdi' (The Blunderer), 1653 or 1655; 'Le depit amoureux' (The Love Tiff), 1656; 'Les précieuses ridicules' (The Affected Ladies), 1659; 'L'Ecole des maris' (The School for Husbands), 1661; 'L'Ecole des femmes' (The School for Wives), 1662; 'Le mariage forcé' (The Forced Marriage), 1664; 'Tartuffe', 1664; 'Don Juan', 1665; 'L'Amour médecin' (Love as a Physician), 1665; 'Le Misanthrope', 1666; 'Le Médecin malgré lui' (The Physician in Spite of Himself), 1666; 'L'Avare' (The Miser), 1668; 'Le Bourgeois gentilhomme' (The Tradesman Turned Gentleman), 1670; 'Les Fourberies de Scapin' (The Rogueries of Scapin), 1671; 'Les Femmes savantes' (The Learned Ladies), 1672; 'Le Malade imaginaire' (The Imaginary Invalid), 1673.

MOLLUSKS. The large group of animals called mollusks or *mollusca* live on land and in water, both fresh and salt. In Latin, *mollusca* means "soft," but many of them certainly do not look very soft. Such mollusks as snails, clams, and oysters have a hard shell enclosing them. The name refers to their bodies. These are soft and not divided into segments as the *crustaceans'* bodies are. All mollusks, whether they have real shells or not, have a sheet of shell-forming tissue called the "mantle." There are four main classes of mollusk.

1. *Cephalopods* (pronounced *sĕf'ȧ-lō-pŏdz*).—The most complex of all mollusks are the cephalopods, or "head-footed" mollusks. Zoölogists call them that because the head is surrounded by a circle of eight or ten tentacles equipped with suckers. Cephalopods like the octopuses have been the subjects of many pictures and stories, and we often think of them as very dangerous animals. But most of them are completely harmless, and some are good to eat as well. In some ways, the cephalopods are almost as complicated in structure and intelligence as the lower vertebrates, or animals with a backbone.

They include the nautilus, the argonaut, the octopus, the cuttlefish, and the squid. The nautilus is the only member of the class now living which carries an external skeleton, or shell. But long before human history began—millions and millions of years ago—many shelled cephalopods swam in the sea. All these except the nautilus became extinct. From their remains in the earth we know that they did not become so big as the cephalopods now living. And we know that the modern nautilus with its shell does not have so big a brain and is not so intelligent as some of the shell-less cephalopods. So we suppose that the shell limits bodily and mental growth. The giant squid probably could never have become a monster of the seas if he had been confined in a shell.

Advantage of Doing without a Skeleton

All the cephalopods that survived and became large have either a small internal skeleton or no skeleton at all. The "shell" of the squid is embedded in the mantle and is only a small flexible piece of tissue. This is called the "pen" because it looks like an old-fashioned quill pen. The cuttlefish has a limy skeleton that supplies the cuttlebone we put in our canaries' cages. The beautiful argonaut, or paper nautilus, does not have a skeleton type of shell at all. What looks like a shell is just a case used by the female to protect her eggs.

A soft mantle encloses the body of the cephalopod. It has a distinct head and the circle of eight or ten sucker-bearing tentacles which gives it its name. The tentacles correspond to the front part of the "foot" in other mollusks. The base of the tentacles forms a disk and the mouth is in the middle of this. On either side of the head are two large unwinking eyes, something like those of a fish. The animal sucks in water and expels it through a siphon formed from the hind part of the "foot." In this way the creature breathes, as a fish does, and it moves about by squirting water through its siphon.

The shape of the body is different in the various forms. Some have globelike bodies and others have conical, egg-shaped, or cylindrical bodies. In most forms a cartilage in the head encloses the brain and organs of hearing and also supports the eyes.

Most but not all cephalopods have an ink bag which manufactures a dark fluid called sepia. When the animal is attacked by enemies, it can discharge this ink through its siphon and escape in the cloudy water. Cephalopods also have pigment cells in their skin. These enable them to change their color instantly. By taking on the coloring of their surroundings they can deceive their enemies and approach their prey without being discovered.

The Oyster and His Relations

2. *Bivalves*.—The second class of mollusks has this name because its shell is in two pieces. The animals in this class have an ax-shaped "foot" which they use for burrowing. They are sometimes called

pelecypods, or "hatchet-footed" mollusks. The class includes the oyster, the clam, the mussel, and the scallop. These animals have a real head when they are young but it almost disappears when they are adult. The two half shells, or "valves," enclose two folds of the mantle and these in turn surround the body and its organs. The animals breathe through gills that lie under the mantle, one on each side.

Bivalves are important to mankind because of the large amount of food they supply. Oyster and clam shells are used to make shell grit, which is fed to poultry as a source of lime. The shells are likewise used as a road-building material, and thousands of tons are used annually in chemical processes. The shells of fresh-water mussels are valuable because pearl buttons are made from them. Certain species of sea oysters supply us with genuine pearls, and pearls of good quality have been found in many kinds of mussels in the Mississippi Valley. Mussels are also good scavengers. They eat decaying material in the lakes and streams that would otherwise pollute the water and make it unfit for other kinds of marine life.

3. *Gastropods.*—The name of this third class means "stomach-footed." The "foot" is a disk used for creeping. On top of this is a twisted hump, covered by the mantle, which contains the digestive organs. Snails and whelks are typical members of the class. The gastropod has a distinct head and one or two pairs of sense organs—the tentacles, or "horns." The two eyes are in the ends of the tentacles. When there are two pairs of tentacles, the eyes are on the hind pair.

More than Half Are Gastropods

The animal usually has a shell which covers it completely. Its body is attached to the shell by a powerful muscle and it can draw itself in and out of the shell. The shape of the hump determines the form of the shell. If it is twisted or coiled, the shell is twisted. In some forms, such as the limpet, the shell is a simple cone. Many gastropods, such as the periwinkle, can close the mouth of the shell with a trap door. Nearly all young gastropods have a trap door before they hatch from the eggs but some discard it afterward. Many forms, especially land snails, keep enemies out of the shell by sharp teeth around the opening. More than half the 65,000 known species of mollusks are gastropods. They are found in all parts of the world.

4. *Amphineura.*—The fourth class is called *Amphineura* because of the doubling of their nerve cords. It contains the chitons, which are mollusks with a "coat-of-mail" shell; that is, a small shell formed only on the upper surface. The shell consists of eight separate plates overlapping from front to rear. The body is usually oval. The head is reduced to little more than a mouth, and the "foot" forms the entire lower surface. Chitons are sluggish creatures which feed on the algae that grow on rocks near the seashore. When disturbed they seize the rock so strongly that it takes a chisel to pry them loose. (*See also* Clams and Mussels; Nautilus; Octopus; Oyster; Scallops; Shell; Snails and Slugs.)

MOLOTOV, Vyacheslav Mikhailovich (born 1890). "The best file clerk in the Soviet Union." That was how one of Molotov's fellow Communists once described him. The "file clerk," however, was to become a foreign minister important in international affairs and one of the most powerful men in Russia.

Molotov was born in the village of Kukarka, or Sovetsk, 500 miles east of Moscow. His family name was Skryabin, and his father was a shop clerk. He went to high school in Kazan, where he joined a students' circle of the Marxist Communist movement. In 1905, at 15, he took part in the "first Revolution."

Assumes Name Meaning "Sledge Hammer"

The next year he took the Communist party oath of loyalty and assumed the name Molotov. In Russian, Molotov means "sledge hammer." Russian revolutionaries took pseudonyms to hide their identities from the police (*see* Communism).

By the time he was 21 Molotov was already an experienced Communist party worker. While attending the Polytechnic Institute in what is now Leningrad, he persuaded many of his fellow students to follow Communism. He also worked as a printer and writer for *Pravda*, the Bolshevist newspaper. In 1913 he was banished from the city but continued his revolutionary activities in the suburbs.

His work as an agitator caused his arrest in 1915, and he was exiled to Siberia. The next year he escaped, returned to Leningrad, and became a close associate of Lenin and Stalin. In 1917 he fought in the October Revolution. From that time he rose steadily in the Communist party and in the government of Soviet Russia. In 1922 he became a member of the powerful Political Bureau (Politburo) and secretary of the Central Committee.

Becomes Premier under Stalin

In 1924 he supported Stalin's successful fight against Trotzky for control of the Soviet government. (*See* Stalin; Trotzky.) Molotov was made premier in 1930 after Stalin became dictator. He held that post until Stalin assumed it in 1941.

In 1939 Molotov became foreign minister. The nonaggression pact which he signed with Germany paved the way for the Nazis' attack on Britain and France. After Germany turned on Russia in 1941, Molotov obtained an alliance with Britain and the United States.

When Stalin died in 1953, Molotov became a member of the new five-man Presidium of the Council of Ministers. He continued in this role and as foreign minister during 1955.

MOLYBDENUM. Factories often run machines at speeds which make the cutting tools red hot. Drills, bits, and hobs made of ordinary steel would lose their cutting edge and shape under such treatment; but a tool made of steel and the alloying metal molybdenum will withstand such heat and continue to cut.

A small percentage of molybdenum improves the quality of gray and malleable iron castings. Certain molybdenum compounds bind glazes firmly to metals and ceramics in making enamelware. Other compounds produce various colors in dyes and pigments. Molybdenum is a catalyst for certain chemical reactions, and it is used in some electric furnaces to conduct heating current.

This useful metal is about half as heavy and hard as tungsten (wolfram). Fine wires made of it have a tensile strength of about 260,000 pounds across one square inch. The melting point of molybdenum is 4,750° F. (2,620° C.), about 1.7 times that of iron.

The United States produces about seven eighths of the world supply, from ores found in Colorado, Utah, Arizona, New Mexico, California, Nevada, and Washington. The other important producer is Chile. The most important ore is a sulfide (MoS_2) called *molybdenite.* It has about 0.5 per cent of molybdenum. The metal content of the ore is concentrated by oil flotation, and the concentrate may be roasted to drive off sulfur and form molybdenum oxide (MoO_3). This can be fused in an electric furnace with ferrosilicon, iron oxide, and aluminum to form ferromolybdenum, the alloy most often used for making steel.

Molybdenum forms stable chemical compounds with a valence of 6, and others with valences of 5, 4, 3, and 2. The atomic number is 42, the atomic weight 95.95. Nonradioactive isotopes have mass numbers 98, 96, 92, 95, 100, 97, and 94.

MONEY—*How People Use It to* BUY, SELL, *and* SAVE

MONEY. Twice during America's history people have taken almost all the United States coins out of use. People hoarded coins during President Van Buren's administration and during the Civil War. They did this because they were afraid paper money had lost its value. Coins, they thought, would always be valuable if only for the copper, silver, and gold in them. Soon there were almost no metal coins to make change. People began to have a great deal of trouble buying things, because they did not want paper money and there were few coins.

Businessmen and others met these emergencies by making and issuing metal and paper tokens. These "hard times" tokens were accepted and used as money. People also used postage stamps for money. These were only makeshift and temporary measures. But they show that people need some medium of exchange —some kind of money—to buy and sell the things necessary for daily living.

Although pictures of United States coins may now be published, the Secret Service generally does not allow bills to be pictured.

What Is Money?

Money, then, is the common *medium of exchange.* People work to earn it. They use it to buy from others the goods and services they need.

Money is also a *measure of value.* It is the yardstick by which the values of goods and services are measured. The price of an article or service tells the buyer how much money he needs to buy it. The same price yardstick tells the seller how much he will get for the things—labor or product—he sells.

Money is also a *store of value.* It is a convenient

"HARD TIMES" TOKENS USED FOR MONEY
These privately coined "hard times" tokens were accepted as money in President Van Buren's first year in the White House.

means of saving, or "storing up," for future use. Finally, money serves as a *standard for deferred payment* This makes it possible to tell how much one owes on goods bought but not yet paid for. (*See also* Banks; Installment Buying; Insurance; Stocks and Bonds, Thrift.)

Trading by Barter

Before there was money in the world people had to get many of the things they needed by trading one kind of goods or service for another. This was called *barter*. Barter, however, was an awkward way of doing business It meant that if a man had a horse he wanted to exchange for a cow he had to find a man who had a cow and wanted a horse. Then too one of the animals might be worth more than the other. What was to be used to pay the difference in value?

Early man soon discovered that there were always some things that everyone wanted. People might want them for their beauty or their usefulness or both. Everybody would accept one or two kinds of things because they knew that others, in turn, would accept them in payment. These things became man's medium of exchange—his money.

This early money, or money material, was sometimes cattle, shells, nails, hatchets, tobacco, furs, rice, tea, and dates. All these and many more useful or ornamental products have at some time and place been used as money.

The early Egyptians, for example, used animals for money. They bought and sold with sheep. Even when they began to use gold, they shaped the gold into the form of small sheep. This showed that the gold could be traded just as live sheep had been traded in the past.

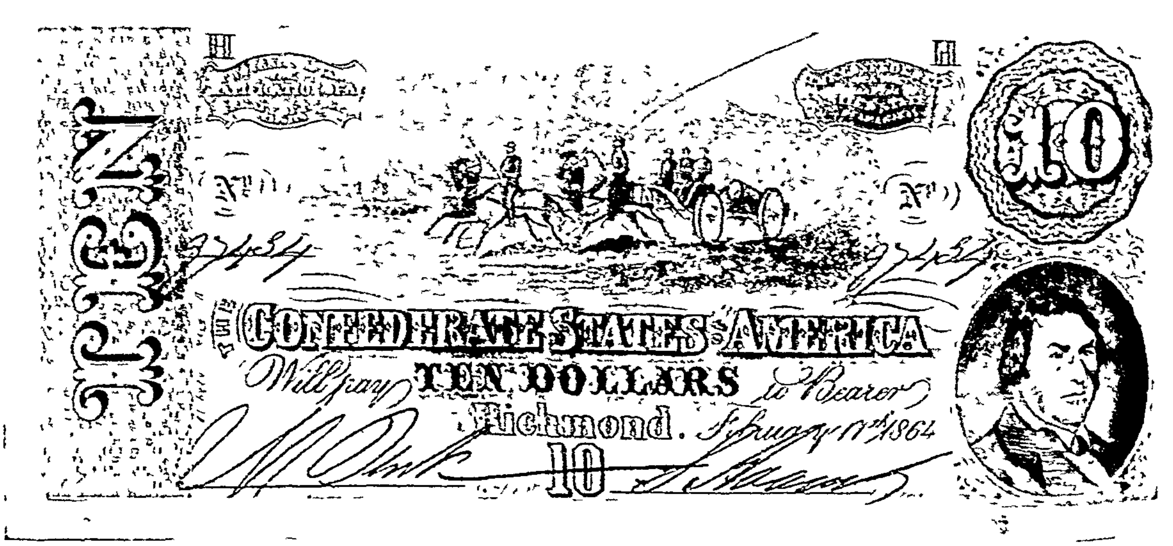
The Invention of Coinage

Among all the materials used by different people as mediums of exchange, certain ones seemed to make better money. These were most often metals A good money material has to be something that everyone knows by sight. This prevents people from using false money. The material also has to be durable and easy to carry. There should not be too much of it in the world. If there is an unlimited supply easily available to everybody, it would have no value.

At first, metal money was in the form of dust or lumps or was shaped into bars. It had to be weighed or measured each time it was used in buying or selling. This was inconvenient. A simpler way was needed. The answer was to make the metal in pieces of fixed, or standard, sizes. These were coins.

Early Coins Named for Weights

Several of the early common coins were named for weights—as the Hebrew shekel, the Anglo-Saxon mark, the later English pound, and so on. But even after standard coinage began, the coins often had to be weighed, because dishonest people clipped or filed the coins to get particles of gold or silver.



A CONFEDERATE $10 BILL
During the Civil War the Confederacy issued millions of these bills. The value of this money depended upon the South winning the war. Toward the end of the war, this currency had decreased in value so much that a $3.00 dress sold for $1.75.

To prevent such theft modern gold and silver coins are made with raised and milled edges, which show plainly any clipping or filing.

Most modern governments have laws that regulate the amount and quality of the precious metal in each coin. Actually, however, a coin need not weigh a certain amount to be accepted as *legal tender.* Legal tender is money which a debtor can legally make his creditors take in payment of a debt. All kinds of United States money are legal tender.

Today silver and gold are the standard metals used for money. A *standard* coin contains the actual value in metal as the value stamped on it. A *token* coin contains less actual value in metal than the value stamped on it. Most modern countries, including the United States, issue only token coins. (For table of United States coins, *see* **Coins** in the FACT-INDEX.) The reason people are willing to take token coins and paper dollars is that they have confidence in the government. (*See* Counterfeiting.)

The Invention of Credit Currency

In the ancient world and throughout the Middle Ages, money circulated on the basis of its metallic content. Kings sometimes took advantage of their power and "debased" the currency by putting out new coins that were smaller than those issued in the past. But in the early modern period it was discovered that a promise to pay money, if there was general confidence in the maker of the promise, would serve most of the purposes of real money.

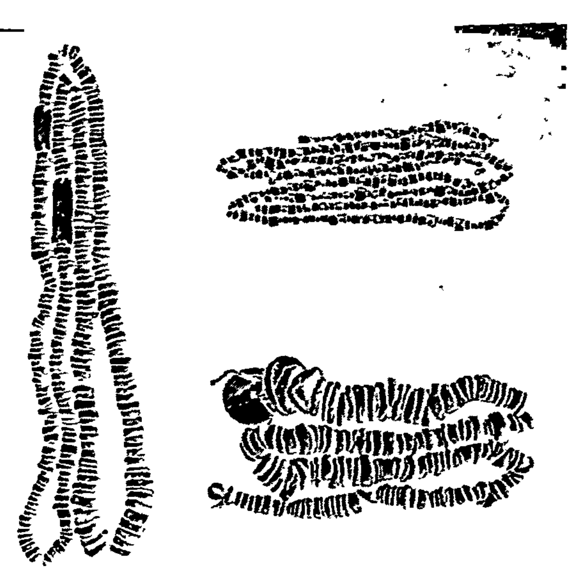
Goldsmiths, merchants, and moneylenders began to issue notes—written promises to pay cash on demand. They found that if they were honest about redeeming these notes very few people asked for redemption. This *credit currency*, being in the form of paper, was more convenient to handle than the gold for which it could be redeemed. It was also less expensive to transport and store. The issuing of such bank notes became one of the important activities of the banking business, nationally and internationally. Governments and bankers issue paper promises to pay gold or silver on demand. (*See* Credit; Foreign Exchange; International Trade; United Nations; for table of foreign monetary units, *see* **Money** in the FACT-INDEX.)

Another form of credit money is the *bank deposit* (*see* Banks and Banking). The banker merely gives a receipt (bank book) for money deposited. This allows customers to transfer their deposits by instructing the banker to transfer amounts from one account to another. This is usually done with personal or bankers' checks.

Kinds of United States Paper Money

Before the Civil War paper currency consisted of bank notes issued by banks operating under federal or state charters. There was no federal paper currency. The first paper money issued by the government of the United States was a series of $5, $10, and $20 treasury notes authorized in 1861 and 1862. United States notes, usually called "greenbacks," were issued for the first time in 1862. These were in the following denominations: $1, $2, $5, $10, $20, $50, $100, $500, and $1,000.

Paper money issued today includes *gold certificates, silver certificates, United States notes,* and *Federal Reserve notes.* Eighty-five per cent of the money in circulation in the United States is in the form of Federal Reserve notes. These are issued in denominations of $5, $10, $20, $50, $100, $500, $1,000, $5,000, and $10,000. They are issued through the Federal Reserve System to the local member banks. Each Federal Reserve bank must maintain reserves in gold certificates of not less than 25 per cent against its Federal Reserve notes in actual circulation (*see* Federal Reserve System).



WAMPUM AND STONE MONEY
Early Americans used Indian *wampum for money* (left). White shells were worth 14 for an English penny; dark, two for a penny.

The largest money in the world is the "rolling stone" money on Yap Island (right). The native is holding Yap shell money.

Gold Certificates Do Not Circulate

Gold certificates are issued in denominations of $100, $1,000, $10,000, and $100,000. They are issued only to Federal Reserve banks against credits established with the treasurer of the United States. These certificates do not get into public circulation.

Silver certificates are issued in denominations of $1, $5, and $10 by the treasurer of the United States. These are issued against standard silver dollars, silver, or silver bullion in the treasury against which silver certificates are not already outstanding.

United States notes are issued in denominations of $2 and $5. A reserve in gold is held in the Treasury against these notes as well as against Treasury notes of 1890. These 1890 Treasury notes, gold certificates which remain outstanding, Federal Reserve Bank notes, and National Bank notes are all being retired from circulation. When they are received at the Treasury they are canceled.

FIRST "TWO-BIT" PIECE
The early Spanish dollar was broken into 8 pieces to make change. In the girl's left hand are a "2-bit" and a "4-bit" piece.

"TEA MONEY"
This solid block of Siberian money is made of pure tea. It passed as currency in Siberia until the end of the 19th century.

The Meaning of Fiscal Inflation

Temporary issues of paper money which will soon be retired out of taxes have been used successfully by many countries. But frequently governments which use this method of financing find that their revenues never catch up with their expenses. This is particularly true during times of war. The paper begins to go down in value as increasing amounts of it are offered in the market for goods. In other words, prices of most commodities rise. The price rise increases the expenses of the government and more paper must be issued. Soon people get alarmed and try to spend their money more quickly than usual for fear it will lose more of its value. This brings prices still higher, and, as the situation gets worse and worse, dangerous *fiscal inflation* results.

"Not Worth a Continental"

During the American Revolution the Continental Congress issued large amounts of paper money. This lost value so rapidly that the saying "not worth a Continental" was used to express its worthlessness. The greenbacks issued by the government during the Civil War were not redeemable at their face value in gold. After the war these notes declined in value until $300 in paper money was worth only about $100 in gold. It was not until 1879, when the Specie Resumption Act of 1875 went into effect, that the government resumed "specie payments" and redeemed greenbacks dollar for dollar with gold. After both World Wars and after the Korean conflict many countries passed through periods of serious fiscal inflation.

The Bretton Woods Plan

In an attempt to stabilize world currency values at the end of World War II, international experts worked out the Bretton Woods plan (*see* World War, Second). Under it the leading foreign trading nations agreed to define the value of their currency in terms of gold and to refrain from changing this value without consultations through the plan's Monetary Fund.

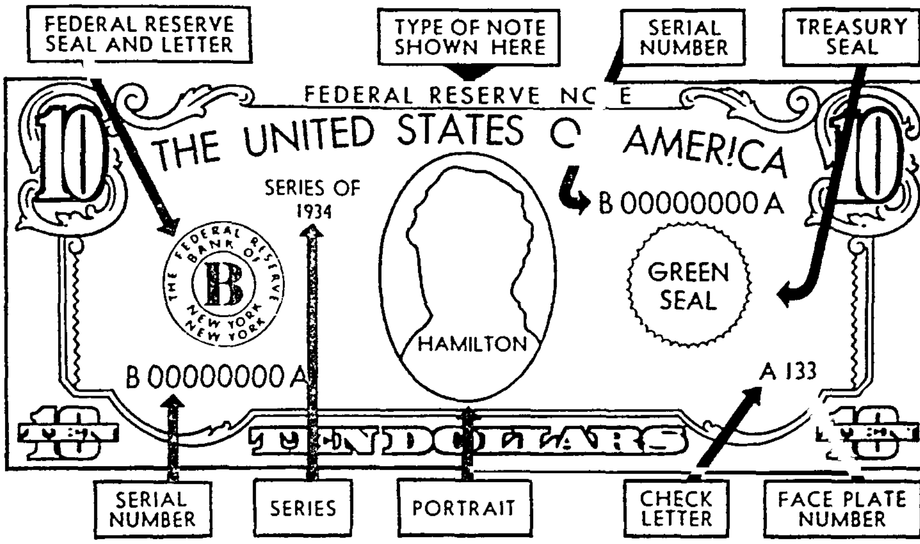
Bimetallism and Monometallism

The system under which both gold and silver are recognized as standard money at a fixed ratio of one to the other is called *bimetallism*. In the United States, for example, both gold and silver were for many years standard money. From 1792 to 1834, 15 ounces of silver were considered equal to one ounce of gold; then, until 1873, when bimetallism was discontinued, the ratio was 16 to 1.

In actual practice the market values of the two metals do not stay the same as the values set by law. As people discover that one kind of metal is worth more than the other, the coin of that metal begins to

disappear. People hoard the more valuable coin and use the less valuable for circulation. This tendency of the cheaper money to drive out the dearer is known as "Gresham's law," after Sir Thomas Gresham, who first stated it in a letter to England's Queen Elizabeth I.

As soon as it is discovered that silver and gold cannot be held at a fixed value to each other, one of the two metals is discarded and the other made the legal tender. This is called *monometallism.* In 1873, for example, the United States made the gold dollar the standard coin after having used both gold and silver as standard coins for many years.



KEY FEATURES ON OUR CURRENCY

This diagram of our $10 bill is reproduced by special permission of the Treasury Department. It shows the position of each item.

America's Money Standard Today

In 1933 the United States government went off the gold standard. This was the result of the world-wide depression which had started in 1929. So many obligations of the government and of private corporations were redeemable in gold that few of the claims could have been met if people had started to present them.

The government recalled all the gold and gold certificates and began buying gold and silver at premiums above the former mint price of gold and above the market value of silver. Soon the Treasury had most of the world supply of monetary gold.

Today the United States monetary system is called a "gold bullion standard" or a "modified gold standard" system. It differs from the former gold standard system in that the government does not issue gold coin, does not allow gold to be hoarded, and issues gold certificates only to Federal Reserve banks. The gold dollar, however, is the standard unit of value. The secretary of the treasury is required to maintain all forms of money issued or coined by the United States at parity with the gold dollar. Gold is also allowed to be exported to pay for goods bought from other countries.

Until 1933 our standard gold dollar contained 25.8 grains of gold and had a fineness of 9/10 gold and 1/10

PORTRAITS AND DESIGNS ON UNITED STATES PAPER MONEY

Denomination	Portrait on Obverse (Front)	Design on Reverse (Back)	Series
$1	George Washington	ONE between obverse and reverse of Great Seal	Silver Certificate
$2	Thomas Jefferson	Monticello	United States note
$5	Abraham Lincoln	Lincoln Memorial	Silver Certificate United States note Federal Reserve note
$10	Alexander Hamilton	United States Treasury Building	Silver Certificate Federal Reserve note
$20	Andrew Jackson	White House	Federal Reserve note
$50	Ulysses S. Grant	United States Capitol	Federal Reserve note
$100	Benjamin Franklin	Independence Hall	Federal Reserve note Gold Certificate
$500	William McKinley	Ornate FIVE HUNDRED	Federal Reserve note
$1,000	Grover Cleveland	Ornate ONE THOUSAND	Federal Reserve note Gold Certificate
$5,000	James Madison	Ornate FIVE THOUSAND	Federal Reserve note
$10,000	Salmon P. Chase	Ornate TEN THOUSAND	Federal Reserve note Gold Certificate
$100,000	Woodrow Wilson	Ornate ONE HUNDRED THOUSAND	Federal Reserve note Gold Certificate

AN EARLY GOLDEN COIN
A highly prized rarity among coin collectors is this golden Offa coined for the Anglo-Saxon king Offa in 757-796.

SILVER SHEKEL OF ISRAEL
The silver shekel of Israel was one of the coins originally named for a weight. It circulated between 141 and 137 B.C.

KING OF AMERICAN RARITIES
The 1804 silver dollar has sold for more than $10,000 at coin auctions, a world's record for the sale of a single silver coin.

copper alloy. Today the United States gold dollar is defined as containing 15 5/21 grains of gold 9/10 fine, which is 1/35 of a fine ounce. Gold is bought by the United States mints and assay offices at $35 per fine ounce. Formerly it was worth $20.67 an ounce.

How Our Money Is Made

All United States money is coined or printed by the Treasury Department. Coins are made by one of the mints (*see* Mint, United States). Paper money is printed by the Bureau of Engraving and Printing, at Washington, D.C. The original master plates are engraved on steel. From these master plates electrotype printing plates are made. The printing plates are coated with chromium, one of the hardest metals known (*see* Electrotyping; Engraving and Etching).

The paper on which the notes are printed is specially made of a mixture of linen and cotton. Embedded in it are colored fibers of silk, nylon, or other synthetic material. From 1861 to 1928, United States currency was of the uniform size of $7\frac{7}{16}$ by $3\frac{1}{8}$ inches. In 1928 the size was reduced to $6\frac{5}{16}$ by $2\frac{11}{16}$ inches.

Every year the government prints more than one billion bills. The average life of a bill is only about a year (less for dollar bills). Damaged paper currency can be redeemed at its face value if three fifths of the note can be sent to the Treasury and at half its value if less than three fifths but more than two fifths is returned.

Tips for Beginning Coin Collectors

A simple way to start a coin collection is to buy a coin folder for United States one-cent pieces and fill the folder as far as possible with coins from circulation. Most cities have dealers who can supply these folders. The beginning *numismatist*, which is what a coin collector is called, should have at least one book on United States coins. This can be bought from a dealer or the publisher (*see* Hobbies).

The "head" of a coin is called its *obverse*, the "tail" its *reverse*. The obverse usually carries the date. All United States coins, except those minted in Philadelphia, also carry a letter to identify the city of their origin. Philadelphia, however, used a P on wartime alloy nickels that were coined there from 1942 to 1945. Coins minted in Denver bear a D, and in San Francisco, an S. The San Francisco mint was closed in March 1955 after being in operation for more than 100 years (it is now used as an assay office). Other mints no longer in operation but whose coins are prized by collectors were located at Carson City, Nev. (CC), Charlotte, N. C. (C), Dahlonega, Ga. (D), and New Orleans, La. (O). Any other initials on United States coins are those of the designer.

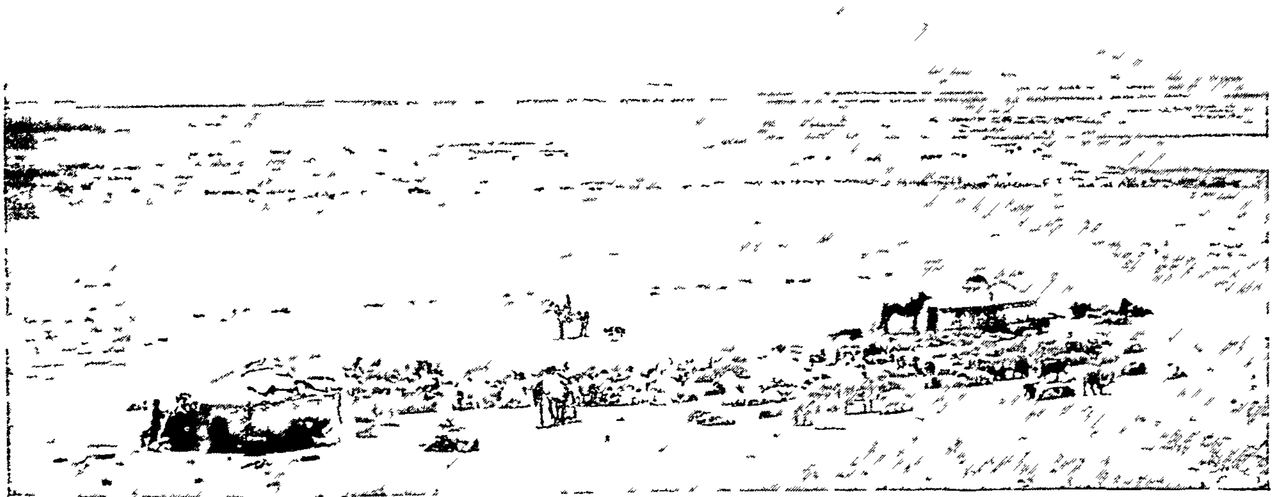
How Coins Are Collected

United States coins are usually collected by dates and mints; by dates, mints, and die varieties; by types (coins of the same denomination that have different designs, such as the Liberty, Buffalo, and Jefferson nickels); or by types and major varieties (the Philadelphia wartime nickel is a major variety).

The value of a coin is determined by its scarcity, its condition, and the demand for it. Conditions range from "fair" to "proof," the intermediate grades being Good, Very Good, Fine, Very Fine, Extremely Fine, and Uncirculated.

Proof coins are specially made for collectors at the Philadelphia mint. They are hand struck from polished metal blanks (planchets) and dies and have a mirrorlike finish. A proof set of the current year's coinage can be bought from the superintendent of the Philadelphia Mint, Philadelphia, Pa. The Treasury Department, Office of the Treasurer of the United States, Washington 25, D. C., will furnish a set of the current coins in Uncirculated condition at face value plus postage and a small service fee.

The GRASSY *Cradle of the* MONGOLS



This typical Mongolian camp stands on a wide stretch of grassland watered by streams from the mountains in the distance. Gathered about the yurts, or movable homes, are the flocks of sheep and goats which provide the Mongolian nomad with his living. They furnish his food—mutton, milk, cheese, and butter—his clothing, and the covering for his shelter.

MONGO'LIA. High amid encircling mountains in the heart of Asia lies one of the oldest and least known lands on earth. Over its cold, dry, wind-swept plains the Mongols, mounted on tough ponies, still range with their flocks and herds as they did before they overran much of Asia and eastern Europe in the 13th century (*see* Mongols). In recent times Mongolia has been a pawn in the struggle for power among its neighbors, Russia, China, and Japan.

Extent.—Estimated area of all Mongolia, more than 1,000,000 square miles. Area of the Mongolian People's Republic (Outer Mongolia), about 626,000 square miles, population (1949 est.), 2,000,000 Area of historic Inner Mongolia (Chahar, Suiyuan, and Ningsia provinces), about 326,000 square miles; population (1947 est), 5,054,126 Area of Inner Mongolian Autonomous Region, of China, about 230,000 square miles, population about 2,000,000

Physical Features.—Mountains· Altai, Tannu Ola, Sayan, Kentei, Great Khingans, Ala Shan, Nan Shan. Rivers· Yenisei, Selenga, and Orkhon in Outer Mongolia, Hwang Ho in Inner Mongolia. Many salt or brackish lakes. The Gobi (Shamo), a rock-floored basin about 1,000 miles east to west, 600 miles north to south.

Products.—Wool, hides, furs, meats, horses and other livestock, from Inner Mongolian farming lands, oats, wheat, buckwheat, millet, kaoliang, soybeans.

Principal Cities.—Ulan Bator (formerly Urga), capital of Mongolian People's Republic, Choibalsan, rail and trading center, Kalgan, Inner Mongolia.

Once all Mongolia belonged to China. Outer Mongolia declared itself free in 1911. Soviet Russia extended its influence there and made the Mongolian People's Republic, founded in 1924, a Russian satellite. The Soviet Union also absorbed the Tuvinian republic in the northwest tip of Mongolia in 1944. When Japan ruled adjoining Manchuria in 1941–45, it won over a large section of Inner Mongolia. Chinese-Russian rivalry changed to an uneasy alliance after China came under a Communist government.

Geographically, Mongolia is a somewhat flat upland encircled by mountains and highlands. It has never been surveyed accurately, and no census of its population has ever been taken; but the estimated area is somewhat more than a million square miles, or as much as all that part of the United States east of the Mississippi River, with Minnesota, Iowa, and Missouri added. Yet the entire population is estimated to be scarcely more than 7,200,000, or less than that of Ohio.

The rock floor of the Mongolian basin is, on the average, about 4,000 feet above sea level. Its weather is harsh, changeable, and extreme. Winters are bitter cold and the days are hot in the brief summer. The climate is dry because the surrounding mountains wring most of the moisture from the winds. The main basin is ridged with chains of hills, low mountains, and sand dunes. Rivers are most numerous in the mountains northwest where rain and snow are heavier. Many rivers empty into salt or brackish lakes without outlet. Along the ancient caravan routes across the Mongolian plateau are wells, some dug hundreds of years ago. Without these wells, travel would be impossible.

Transportation and Communication

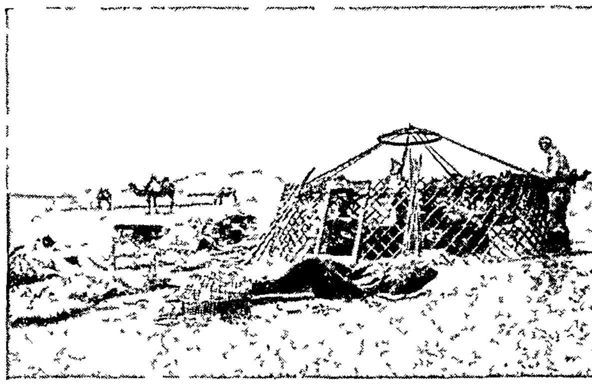
Russia and Japan became interested in Mongolia largely because railroads might be built across it to connect with the great Trans-Siberian Railway and the Manchurian lines. Ulan Bator (Urga), the capital of Outer Mongolia, has airplane service to the Soviet Union and radio and telegraph service. Elsewhere the mail is carried by horsemen; relays of horses are kept at post stations for their use. Trade goods are transported mostly by pack animals or in heavy carts drawn by bullocks or camels. Automobiles can be used, even without roads, over great stretches of the flat, dry country; at times a motor service has been maintained in summer between Ulan Bator and

Kalgan, the starting point for caravans on the border between China and Inner Mongolia. However, automobiles will be few until gasoline becomes cheaper.

Political and Natural Divisions

Its natural features divide Mongolia into three parts—northwestern or Outer Mongolia, southeastern or Inner Mongolia, and the Gobi between. The Mongolian People's Republic holds the mountains and plains of Outer Mongolia and the arid Gobi. Inner Mongolia is today part of the Chinese People's Republic (Communist China). It formerly included the provinces of Ningsia, Suiyuan, Chahar, and at times Jehol. In 1949 and 1950 the Communist government reorganized the country, setting up new administrative areas. As the map shows, most of Inner Mongolia is now incorporated in the Northwest Administrative Area and the North China Central Control Area. A new Inner Mongolian Autonomous Region was organized to the east of Outer Mongolia. It contains the northeastern part of historic Inner Mongolia and considerable territory formerly in western Manchuria (*see* Manchuria).

MOVING DAY AMONG THE NOMADS



Frequent moving days make the Mongol an expert at taking down or setting up his dwelling. Here we see a man attaching the sticks for the sides of the conical roof, while his wife holds the top piece in place with the center pole. Strips of felt over sides and top will complete the yurt, and the whole task takes only a half hour. The basket in the foreground is used for argul, the Mongol's only fuel. Beyond the basket is a water cask.

Outer Mongolia shares with Siberia the mountains to the northwest. They are forested on their northern slopes. Broad grassy steppe spreads east and south toward the Gobi. Rainfall ranges from 10 to 20 inches, and there are great extremes of temperature between summer and winter.

Inner Mongolia, separated from North China and from the Gobi by mountains, has grassy plains interspersed with poor steppe and desert. It feels the edge of the southeastern summer monsoons. In some places these winds bring enough rain for farming. The farmers are chiefly land-hungry peasants from China.

AN INGENIOUS WAY OF MAKING FELT

Felt making seems to be a community business. First the Mongols spread a thick layer of sheep's wool, loosely twisted, on a strip of felt and soak it with water or whey. After placing a second felt strip over it, they roll the whole thing on a pole, wrap it in cloth, and bind it firmly. Then they attach ropes to the end of the pole and a camel or a horse drags it over the plain for an hour or two to pack the wool into felt.

The broad, shallow basin of the Gobi is poor steppeland as well as true desert; in fact, *gobi* is the Mongol name for any broad expanse of semibarren country. Thinly covered with gravel and sand, scoured by high winds, seldom visited by rains, it yet nourishes a scanty growth of wiry grass, thorny bushes, and low sagebrush. This poor fare supports gazelles, wild asses, and many other wild creatures, as well as the camels and other domestic animals of the Mongols. Hundreds of miles apart stand a few stunted trees, two centuries or more old. They evidently started to grow when the land had more moisture than it does at present, for no young trees or saplings exist.

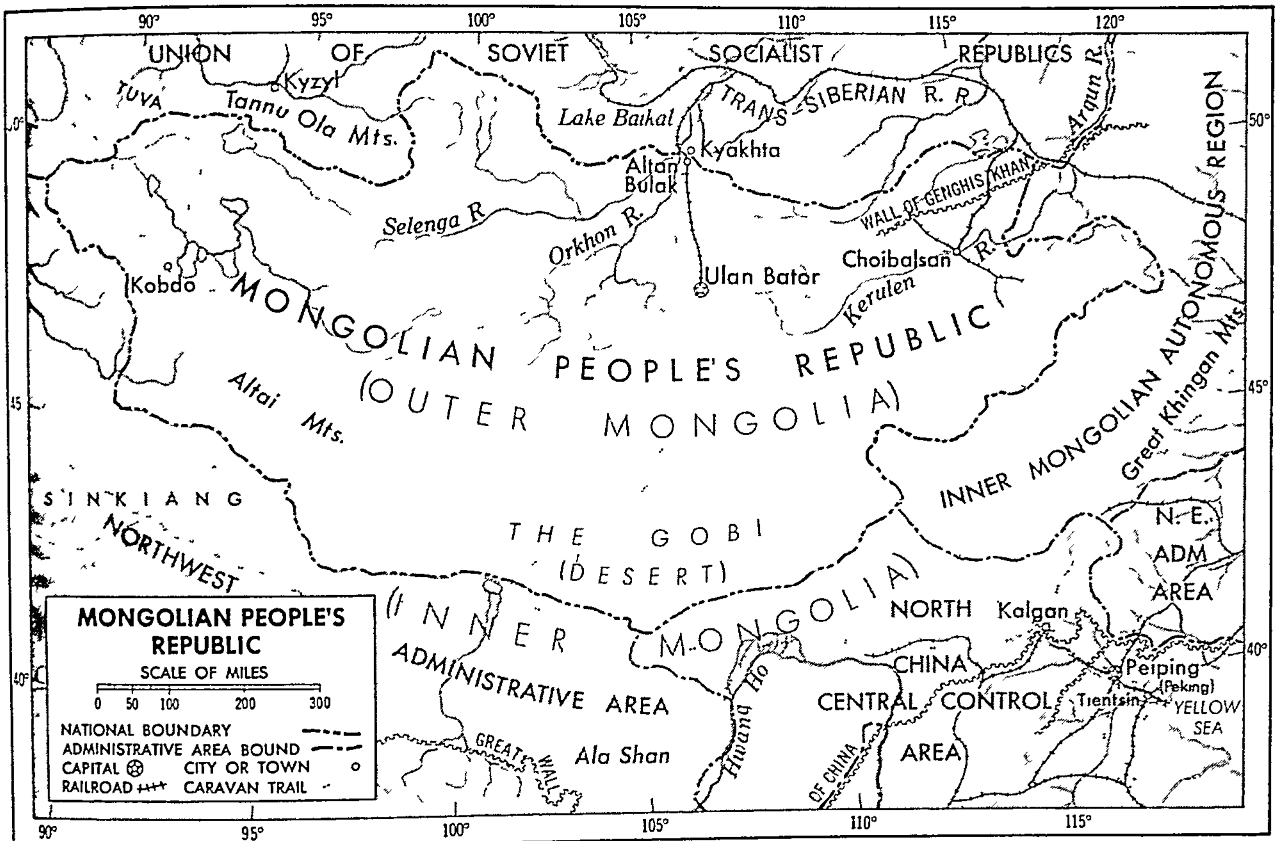
Fierce winds seem to blow forever here, with now and then a twisting "wind-devil" that covers everything with dust and sand. The heat of the summer sun smites through the dry air to make the bare rock almost blistering hot. Through the same dry air in winter the heat of the land radiates and is lost, and temperatures may fall to $-40°$ F.

The Gobi, poor and bare as it seems, is rich in relics of past land life. That is because through most of geologic time, the region has escaped being covered by the sea, and land plants and animals have flourished continuously. Here even now are more wild animals than may be found in the northern forests. Here scientific expeditions under Roy Chapman Andrews found relics of the mysterious Dune-Dwellers, an ancient people who lived long before the dawn of history; the bones of a baluchitherium, hugest of known mammals; dinosaur eggs, and tiny skulls of the oldest known true placental mammal (*see* Exploration).

How the People Live

On the grasslands of Outer Mongolia, the Gobi, and those parts of Inner Mongolia too dry for farming, the people are roving stock herders. Finding water and grass for their flocks and herds is their greatest problem. They seldom use precious water to wash their bodies or clothes. They lick the dishes clean. When wells and pasture fail in one place, the tribe sends out scouts to find a new camp ground. Then the families take down their tents and load tent frames and covers, blankets, iron pots, and wooden utensils on the pack camels. The women ride the loaded camels, singing as they go. Men and boys on horseback herd the feeding animals. From their herds the Mongols get almost everything

HOW ANCIENT MONGOLIA IS DIVIDED AND RULED TODAY



Centuries ago when the vast homeland of the Mongols was ruled by old China, the part nearest the Great Wall was called Inner Mongolia, and the more distant part Outer Mongolia. Today the latter has become the Mongolian People's Republic, a satellite of Russia. Inner Mongolia is part of Red China and is divided among administrative areas there. Notice the rail lines that have been built to speed trade with Russia. Parts of the caravan trails can be used by cars.

they need. The sheep furnish mutton, cheese, butter, sheepskin clothing, and wool for making the felt used to cover their movable homes, or *yurts*, and for bedding. Goats are kept, and in a few localities outside the Gobi the Mongols raise cattle. Most of the cattle are traded or sold, for the Mongol prefers mutton to beef. He uses milk from mares and cows to make a fermented drink, *kumiss*. The shaggy winter coats of the two-humped Bactrian camels are plucked when the hair starts to shed in June; much of this hair eventually is used in American coats and blankets. Wood is scarce, except in the north; so the Mongols burn the dried droppings of animals, called *argul*.

Dress and Customs of the Mongols

Sheepskin is the regular garb in winter, cotton cloth in summer. Both men and women like to dress in gay colors. On festal occasions the women wear a gorgeously ornamented headdress. In the Chahar region of Inner Mongolia, this is a net of coral and silver. The women of Outer Mongolia dress their hair in huge grotesque bows like the horns of a mountain sheep. It is said that a Mongol's wealth may be judged by the jewels in his wife's headdress.

Furs, hides, wool, camel's hair, and animals are bartered for imported products like tea, flour, sugar, tobacco, the cotton cloth used for tents and summer clothing, saddles, boots, and jewelry for the women. Camels are used to carry loads and draw the high-wheeled carts; but Mongols rely mostly upon horses for transportation. Children learn to ride at about four. A Mongol's flat felt boots make walking uncomfortable. He jumps on a pony to go even a short way.

The men and boys love to race their horses over courses five, ten, or even twenty miles long, beating the animals the whole way. A fast pony means a fortune to a Mongol, and Mongolian ponies are famous for their speed and hardiness. Mongol horsemanship is seen at its best when a rider captures a wild horse. He stands upright in the stirrups and carries an odd sort of lasso, a long pole with a loop of rope on the end. When he nears the wild horse, he takes the reins in his mouth and uses both hands to drop the lasso loop over the wild horse's neck.

The distance between wells is so great that loss of one's pony may mean death. Therefore, as in the pioneer West in the United States, death is the penalty for horse-stealing.

Next after horses to ride, the Mongol needs dogs, the more savage the better, to guard his yurt or caravan. These are usually large Tibetan mastiffs, but may be smaller mongrels. These dogs are man-eaters, and will attack a stranger on sight.

Character of the People

Desert or nomad life is hard and encourages ignorance and dirt. But the Mongol enjoys his life, and achieves a rude plenty which is far better than the

poverty-ridden life of Chinese peasants. Like most desert dwellers, Mongols are hospitable, fun loving, and self-reliant. They have no chance to grow "soft." Babies two or three years old will run about naked in a wind which would make an American shiver inside a fur coat. Though Mongols may seem lazy to the casual stranger, they take necessary hard work uncomplainingly. Children five or six years old begin to herd sheep and goats; a little later they may spend long nights alone in the desert herding cattle and ponies. Women and girls do the cooking, milking, and cheese making. They weave cloth for their long robes.

Mongols, like the Chinese, belong to the so-called yellow race; but the tastes and habits of Mongols and Chinese are so different that there is very little intermarriage. Where the Chinese farmer comes in, the Mongols move on, as American Indians moved on when the white men came. Many Mongols strikingly resemble Indians in appearance and nature. Such people have little use for fixed dwellings. Only temples, monasteries, and the principal buildings of the few towns are solid wooden structures. Towns may grow up as trading centers and vanish again as the people drift to new pasture lands. Many towns marked on maps of Mongolia are little more than camp grounds, only occasionally filled with tents.

LIVING SNUGLY IN A YURT

Winter winds may howl but they do not penetrate the Mongol's felt-covered yurt or his sheepskin gown made with the woolly side in. In the background we see the family shrine, which is always placed opposite the entrance. Models of Buddha, paintings of the wheel of life, and other scrolls of Lamaism may be found upon it. The brazier in the foreground is heated with argul. Its four prongs are intended to hold a great iron bowl, the Mongol's only cooking pot.

Land Held in Common by Tribes

Where ancient tribal customs are still followed, land belongs not to the individual but to the tribe. The tribe has its regular seasonal grazing grounds, and within these limits individuals and families have space allotted to them for the season. In Outer Mongolia, before the foundation of the Mongolian People's Republic, the princes and the lamaseries, or monasteries, had become great landowners, and the common people had become little better than serfs. On the desert, and in poorer parts of Inner Mongolia, the original nomadic freedom still prevails. A commoner may become rich and his children be educated, while a prince may be poor and his children uneducated.

Lamas and the Lamaistic Religion

The Mongols are not increasing in number. Many observers attribute this in part to the devotion of the people to Lamaism, a debased form of Buddhism introduced among the Mongols from Tibet some centuries ago. Every family wanted to give at least one son to the Lamaist priesthood. The proportion of men withdrawn from ordinary family life was very great.

The priests and monks, called lamas, lived in great lamaseries (monasteries) or wandered about the country in their red or yellow robes, honoring various households with their presence. Some were intelligent and public-spirited men; most were ignorant and many were unprincipled. Both the lamas and the "living Buddhas," holy men who were supposed to embody some attribute of the divine Buddha, exercised tremendous power among the people.

Violent History

After the Chinese Revolution broke out in 1911, Outer Mongolia declared itself autonomous—that is, independent as far as internal affairs were concerned—and chose as its ruler the Living Buddha of Urga. After 1917 came a period of banditry and savage attempts by the Chinese to reassert their sovereignty and attempts by the mad White Russian, Baron Ungern von Sternberg, to gain control.

In 1921 Soviet Russian troops entered Outer Mongolia and swept out both the Chinese and the White Russians. Under Russian influence the Mongolian People's Republic was set up with its capital at Urga (now called Ulan Bator), and the Tuvinian People's Republic (Tannu Tuva) was established in the far northwest, with its capital at Kysylkhoto, now Kyzyl. The Communist government broke the power of the lamas and deprived the princes of their land and privileges. In 1944 Tannu Tuva joined Soviet Russia as the Tuvinian Autonomous Region, or Tuva.

Trade Flows to Russia

Chinese traders, who once held an oppressive monopoly of Mongolian trade, were barred from Outer Mongolia. Trade which previously flowed southeast over the old caravan trail from Ulan Bator to Kalgan and into China has been turned to run north by the new rail line at Kyakhta in Siberia and the Trans-Siberian Railway. Russia gets nearly all the trade of the Mongolian Republic. It produces wool, hides, furs, meat products, and camel's hair. The Mongolian Republic imports from Russia a large number of commodities; grain, flour, and oil products are the most important. Most of the people are still nomadic herdsmen. But the Russians have made some progress in teaching farming and modern methods of stockraising. Russia has also promoted tanning and shoe factories, wool-washing plants, electric power plants, and other industrial concerns. Some coal and gold are mined.

In the borderlands of Inner Mongolia, the rainfall, though scant, is sufficient for raising such hardy

crops as oats, barley, millet, and kaoliang. Here Chinese farmers have pushed the Mongol herdsmen from the best lands. Naturally the Mongols grew more and more dissatisfied with Chinese rule. Therefore the Mongols of Jehol (eastern Inner Mongolia) and of the Hsingan region of Manchuria, being promised self-rule under Japanese overlordship, willingly cast in their lot with the new state of Manchukuo (*see* Manchuria).

Japan soon encouraged the rest of Inner Mongolia to seek separation from China. Japan hoped thus to set up a buffer state to shut Russia off from North China and protect Manchukuo against possible attack by Russia through Outer Mongolia. With aid from Japan, Prince Te Wang of Chahar forced China in 1934 to establish an Autonomous Government of Inner Mongolia, which included virtually all the region. In 1937 Inner Mongolia renounced all connection with the Chinese government and declared itself an independent state (Meng Chiang).

This extension of Japan's influence westward clashed with Russia's interest in Outer Mongolia (Mongolian People's Republic). As early as 1932 the two major powers gave armed aid to their puppet states in frontier skirmishes arising from border "violations." In 1945, after the second World War, Inner Mongolia was restored to Nationalist China. Then Chinese Communists seized it, lost it in 1946, and regained it in 1948. They signed a ten-year economic and cultural agreement with the Mongolian Republic late in 1952. (For Reference-Outline and Bibliography, *see* China.)

MONGOLS. The story of this nomad people of Central Asia is one of the strangest in history. A rude, almost unknown tribe or group of tribes, learning the art of war in obscure struggles with each other and with their civilized Chinese neighbors, they suddenly blazed forth in the 13th century under brilliant military leaders as conquerors of the best parts of Asia and eastern Europe, supplanting native dynasties in one great kingdom after another. Again and again, when the force and ability of the original stock seemed exhausted, fresh and vigorous offshoots renewed the career of conquest. Finally, after making the Mongol name a world terror for several centuries, they have sunk back again into gray obscurity pent within their historic homelands.

Squat wiry horsemen, hunters, and herdsmen, the tent-dwelling Mongols roved over the cold mountain region south of Lake Baikal and the open steppes, much as the North American Indians roamed over the western prairies before the coming of white men. In the early 13th century Genghis Khan (1162–1227), having welded his wild tribes into a remarkably strong and efficient fighting machine, turned this army first against the neighboring Tatar tribes, which he amalgamated with his own, and then against the already collapsing Kin dynasty of China. He took Peking in 1214, and subdued all China except a small portion in the south. Then, turning his armies westward in 1219, like nightmare apparitions out of a dim land of fable, against peoples who had never heard of Mongols, he swept over Turkestan, Persia, and the southern part of the Grand Duchy of Kief in Russia. He died in 1227, at the height of his triumph, leaving an empire that stretched from the Amur River and the Yellow Sea to the Persian Gulf and the mouth of the Dnieper on the Black Sea.

The lieutenants of his son and successor, Ogdai Khan, carried fire and sword through Georgia, Armenia, Bulgaria, Hungary, Poland, and nearly all Russia. They displayed, along with frightful ferocity, surprising knowledge of the political affairs of the invaded countries, and a command of military strategy quite beyond that of any European general of the time. The death of Ogdai, and troubles of a disputed succession, recalled the Mongol hordes to Asia and perhaps saved the rest of Europe. Hulagu, a grandson of Genghis Khan, exterminated the Assassin order in Persia, overthrew the califate of Bagdad, massacring the inhabitants of the city (1256) and ravaging Mesopotamia. He destroyed its immemorably ancient irrigation system, and so turned those fertile lands into a desert. Leaving famine and desolation behind, he continued on into Syria. Created governor of Persia by the Great Khan, Hulagu founded a dynasty of practically independent rulers, the Ilkhans of Persia, which lasted until 1353.

The Reign of the Great Kublai Khan

A brother of Hulagu, Kublai, who became Great Khan in 1260, completed the conquest of China and founded the Yuan dynasty, which ruled there until 1368. Sovereign or overlord from the Black to the Yellow Sea, Kublai Khan was ruler over more human beings than had ever before owed allegiance to one man. The first of his race to evince traits of benevolence or magnanimity, or any interest in arts of culture, he had adventurers from as far west as Constantinople and even Venice among his ministers, generals, governors, envoys, physicians, and astronomers. It was during the reign of Kublai Khan that the first reports of the wonders of "far Cathay" came to the ears of an astonished and incredulous Europe through the tales of the returned Venetian traveler, Marco Polo (*see* Polo, Marco).

After the death of Kublai Khan the Mongol Empire fell apart into four, five, and then innumerable fragments; yet there was power even in its decaying members. The most important of these, besides the Chinese and Persian empires, was the "Golden Horde," or empire of the western Kipchaks, which established a suzerainty over Russia which lasted until 1480, when the Grand Duke of Muscovy cast off the Mongol yoke.

In the 14th century a Mongol chieftain of Turkestan, said to be of Genghis Khan's blood, though not a direct descendant, once more erected a huge "empire of desolation" covering Persia, Afghanistan, northern India, Mesopotamia, and the greater part of Asia Minor. This was Timur Leng or Tamerlane (Timur the Lame), whose career was used by the

great Elizabethan dramatist Marlowe as the basis for his tragedy "Tamburlaine the Great." His crowning achievement was his conquest of Asia Minor from the Turkish Empire through the defeat and capture of Sultan Bajazet I in 1402; but like their opponents these Mongols were of Mohammedan faith. Timur's method of dealing with a rebellious city was to level it to the ground and sow barley on its site; pyramids of skulls were "his particular architectural fancy." His power died with him in 1405, though his descendants for a time retained a shadowy authority in Persia.

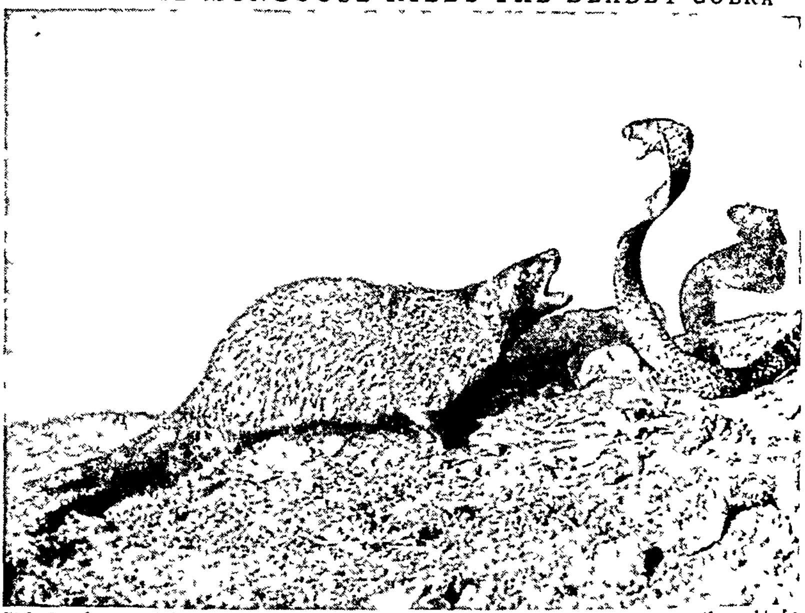
About a hundred years later one of Timur's descendants, Baber (1483–1530), the exiled and outlawed ruler of a petty kingdom in what is now Russian Turkestan, became through a curious combination of pure chance, imaginative daring, and military ability the Mohammedan conqueror of northern India and the founder of the Mogul (Mongol) empire of India Akbar, Baber's grandson, who ruled India from 1556 to 1605, showed a genius for rule as well as conquest; more, he was a robust and broad-minded statesman who attempted to create a united India out of its unhappy jumble of warring races and religions. He was not merely one of the greatest of Indian rulers, but "one of the hinges of history." In his reign England first entered into relations with India and he was "the Great Mogul" to whom Queen Elizabeth I sent a letter. None of Akbar's descendants came up to his stature or had his vision, though his grandson Aurungzebe extended the limits of the Mogul Empire. But that power was internally decaying at Aurungzebe's death, in 1707, and under his feeble descendants in the 18th century it fell into the hands of English rulers (*see* India).

The Mongols of the present day are one of the chief branches of Asiatic peoples. They are divided into the East Mongols, living in Mongolia and Tibet; West Mongols or Kalmucks, living in Mongolia and Siberia; and Buriats, living around Lake Baikal, Siberia. They are still tent-dwellers and nomadic herdsmen. Most of them are Lamaistic Buddhists; a few are Mohammedans; and the Buriats still hold to their ancient Shamanism.

The name "Mongolian" was given to the yellow branch of the human family because the early students of anthropology took that people as typical of the yellow race. The designation of "Mongolian" is very unpleasant to such peoples as the Chinese.

MON'GOOSE. The little weasel-like mongoose may be a hero as a snake killer in India, but it is a criminal elsewhere. This was learned in 1870, when the mongoose was taken to the West Indies to wipe out the fer de lance snake in Martinique, and sugar cane rats in Jamaica. It did so; but then it sought food by attacking poultry, ground-nesting birds, lizards, and other snakes. But many of these animals were insect eaters. As soon as the mongoose cut them down in number, insect pests increased.

HOW THE MONGOOSE KILLS THE DEADLY COBRA



It is hard to explain the wild fury which takes possession of a mongoose at the sight of a cobra, that most poisonous of snakes. The little creature bristles and trembles with rage. Approaching softly, the mongoose makes a feint, leaping forward and away. The cobra strikes out again and again, but despite the snake's lightning speed, the mongoose is quicker. Soon the cobra becomes dazed and uncertain in its movements. At that moment the mongoose closes in like a flash, seizes the snake behind that great hood and breaks its neck. The mongoose frequently eats the cobra's head, poison glands and all. Although he is in no sense immune to the bite of the snake, when the poison is swallowed it does him no harm.

Thus the West Indians learned to their cost that introduction of a new plant or animal can easily upset the *balance of nature*. (*See also* Nature Study.) To prevent the same trouble in the United States, the Lacey Act of 1900 forbade importation of any live mongoose. None may be brought even to show in zoos.

Mongooses live in burrows, and raise from one to four young, usually once a year. About 20 species are found in Africa, Asia, and southern Spain. They are from 14 to 45 inches long. The Indian mongoose is brownish gray, and about 16 inches long. The Egyptian mongoose is called the ichneumon (*see* Ichneumon). Scientific name of Indian mongoose, *Herpestes mungo* (or *griseus*).

MONITOR AND MERRIMAC. On the afternoon of March 8, 1862, five vessels of the United States Navy lay at anchor in Hampton Roads. Suddenly a queer object came across the water toward the United States vessel *Cumberland* from the Confederate stronghold in Norfolk, Va. Really it was a reconstructed United States ship, the *Merrimac*. The vessel had been

sunk when the Norfolk navy-yard was abandoned at the beginning of the war. The Confederates had raised the vessel, cut off the sides, covered what was left with iron plates, and renamed it the *Virginia*. This was one of the earliest practical applications of armor to a warship.

The queer-looking object steered straight for the *Cumberland*. It was met by a heavy fire, but when it reached the *Cumberland*, its iron beak cut through the side of the wooden vessel "as a knife goes through cheese." The *Merrimac* next set fire to the *Congress* with red-hot shot from her guns. Then the queer vessel steamed away, expecting to return the next day and finish the work.

But next morning the situation was entirely changed. When the *Merrimac* started towards the *Minnesota*, thinking to dispose of her as quickly as she had her two victims of the previous day, there suddenly appeared in her path a funny little object, about one-fourth the *Merrimac's* size and resembling nothing so much as "a cheese-box on a raft." This was the famous *Monitor*, a Federal ironclad designed by John Ericcson, a Swedish engineer.

The fight between the two queer ships began at once and lasted for nearly four hours. The *Monitor* was more easily handled than the *Merrimac*, but her shots could not do much harm to the other's iron sides. On the other hand, the *Monitor's* single revolving turret offered a hopeless target for her opponent. Thousands of people stood on the shore and breathlessly watched the combat, the distance between the vessels varying from a half-mile to a few yards. Finally the *Merrimac*, badly damaged, steamed away to Norfolk.

This fight between the *Merrimac* and *Monitor* was one of the most important naval battles ever fought, for it made all the old navies useless. All countries now had to discard their wooden vessels and begin to build ironclads. As one man said, "The wood en walls of England must now be turned to iron.'

OUR ACROBATIC FRIENDS *of* FOREST *and* JUNGLE

A Visit to the Tropics and the World's Most Playful Animals—The Tribes that Dwell in Monkey Land, Their Funny Looks and Queer Customs—Differences between Old and New World Monkeys

MONKEY. Can you think of anything that will collect a crowd of children so quickly, or keep them happy so long, as an organ grinder with a monkey? The music is often very dreadful, but the monkey is very funny. His tiny wrinkled face is so comical. It looks like that of a wise little old man who has seen a great deal of trouble. Like a good clown in a circus, a monkey doesn't have to do anything to make people laugh—except just *be* a monkey. He is so wonderfully agile, quick, and clever. He mimics everything people do. He "makes faces," and he dances to music; he runs up the telegraph pole, a tree, or a porch pillar, and he swings from bars like a trapeze performer. He picks up pennies, stuffs them in the pocket of his absurd red jacket, and pulls off his collar-box cap for thanks.

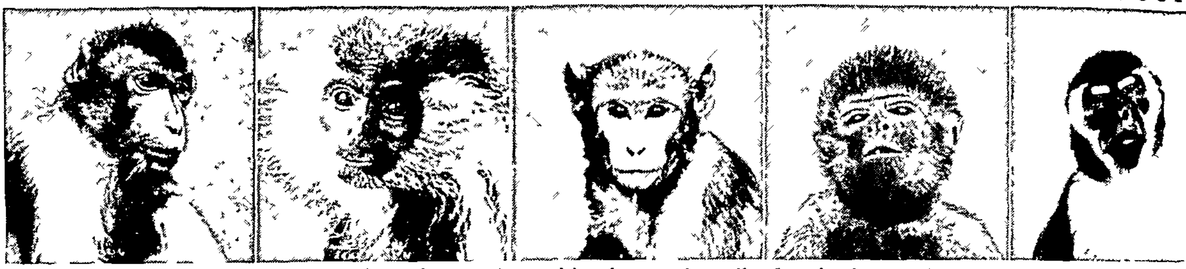
It seems a pity that a monkey can only chatter or scream or scold, for he tries ever so hard to talk. Such a mischief he is, too! If he sees a chance he will snatch a little girl's doll or a woman's hat and tear it to pieces. He knows very well such behavior is naughty, for he scrambles out of reach of punishment, and chuckles with glee over the trick. It's easy to forgive the little rascal, for the next instant he does something engaging. He cuddles his baby, or cracks a peanut like a squirrel, turns a hand-spring for you, or slyly pulls another monkey's tail.

Just what *is* a monkey?

The Great Variety of Monkeys

In the big cage in a menagerie or zoo there are a dozen or more varieties of monkeys as unlike each other as a fox terrier is unlike a St. Bernard dog. Some monkeys are as small as squirrels and others are as large as cocker spaniels. There are monkeys, or apes, with long curly tails, with straight tails, bushy tails, stub tails, and no tails at all. Some have very

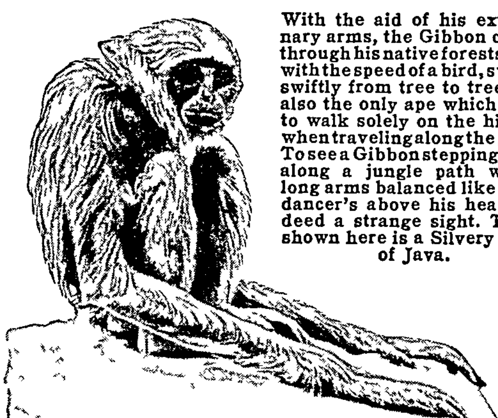
WHAT DO YOU SUPPOSE THESE MONKEYS ARE THINKING ABOUT?



You can almost imagine that they're sitting in a station waiting for a train or lined up in the grandstand watching a baseball game. That first one—the Pig-Tailed Monkey—might well be a serious business man, with no nonsense about him. The Angola Colobus next to him is the very image of an old white-haired lady, who has lost her teeth; and in the middle the Rhesus or "Bandar" of India resembles a mischievous schoolboy in appearance as well as in habits. But what do you think of Number 4, with his puffed up expression? They call him Humboldt's Woolly Monkey, but you might almost take him for a pompous little lawyer; and right there beside him, peering from under his white eyebrows, sits the gruff and solemn judge — the White-Collared Mangabey.

hairy, and others nearly naked, faces. There are dog-faced and purple-faced monkeys; monkeys with white cheeks, with turned-up noses, with tufted ears, with whiskers, mufflers, and bonnets. Most of them are black, gray, or some shade of brown, from silver-fawn to seal. But there are dandified monkeys with green coats and orange vests.

Many people include the big apes—the gorillas, chimpanzees, orangutans—under the name "monkeys." But this is a loose and confusing usage. It is better to refer to these higher forms as *apes*, for there are greater differences in physical structure between the higher apes and some of the monkeys than there are between the higher apes and man. The true monkeys should also be distinguished from the lemurs and other lemur-like animals, which make

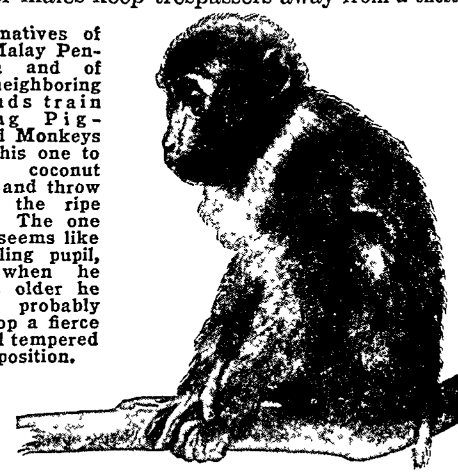


With the aid of his extraordinary arms, the Gibbon can race through his native forests almost with the speed of a bird, swinging swiftly from tree to tree. He is also the only ape which prefers to walk solely on the hind legs when traveling along the ground. To see a Gibbon stepping gravely along a jungle path with his long arms balanced like a ballet dancer's above his head is indeed a strange sight. The one shown here is a Silvery Gibbon of Java.

up the lowest group of the Primates—the order which also includes monkeys, apes, and man. (*See* Ape; Lemurs; Man.)

Monkeys inhabit the warm regions of both hemispheres. They are found in China, Japan, India, and southern Asia to and including the Malay islands, and in all parts of Africa except the deserts. In Europe they are found only at Gibraltar. The New World monkeys are found in the tropical regions of Central and South America, east of the Andes Mountains.

A monkey in captivity is happier in a cage with a number of other monkeys. "The more the merrier" is the rule in monkey land. Nearly every kind of monkey lives in a village in the trees, when he is at home. There is a wise old male for a chief. He and the older males keep trespassers away from a chosen



The natives of the Malay Peninsula and of the neighboring islands train young Pig-Tailed Monkeys like this one to climb coconut trees and throw down the ripe fruit. The one here seems like a willing pupil, but when he grows older he will probably develop a fierce and ill tempered disposition.

feeding place, and he leads his followers to a new home when they move. Early in the morning and late in the evening seems to be playtime in monkey town. All the monkeys leap and swing and chase each other through the trees, and "whoop and holler," as Riley says, like so many boys playing in the woods. Spoiled boys they are, too, doing a great deal of mischief by throwing down coconuts and other fruits and nuts, just to see them fall or to vex passers-by.

Some of these monkeys have the prettiest homes! They camp out all the year round. They love the dense woods of very hot countries. In the beautiful tropical forests along the Amazon River of South America, monkeys live in bowers in the trees, among red and green parrots, butterfly orchid blossoms, brilliant insects, and flowering vines. They live in thousands of tropical islands in the sea, among palms and fruit trees. But a few are found in colder countries—in Mexico and in the mountains of India, in Japan and northern Africa, and even around the great fortress rock of Gibraltar, in Spain.

No matter how much monkeys may differ in other things, they are all alike in having four *hands*. The bear, the lion, the elephant, the dog—nearly all the animals you can think of—have four *feet*. Girls and boys have two hands and two feet. A foot has a long

A "WEEPER" AND A "HOWLER"

The Capuchin or Sapajou Monkey on the left is sometimes called a "Weeper" by South Americans because his voice sounds like a crying child. But that's really nothing but bluff. Instead of sadness, these monkeys are filled *with a rampant spirit of mischief.* There's no bluff, however, about the Red "Howler" at the right. He and his tribe with their unearthly cries make hideous the nights in the South American forests.

sole and short toes, usually, and the toes cannot grasp and hold things. A hand has a nearly square palm, fingers much longer than the toes, and a thumb. In the best kind of hand the fingers have three joints each, and can all be brought together in many positions, and even closed into a fist. All four of a monkey's feet are really hands, with grasping fingers and more or less perfect thumbs. That is why a monkey is so clumsy on the ground. Usually he walks on the outside edges of the palms of his hands, with fingers and thumbs curled in. This gives him a funny bow-legged look. But just watch him on a tree or a perch, or clinging to the wires of his cage. He's as much at home in a tree as a bird or a squirrel.

FEET THAT ARE REALLY HANDS

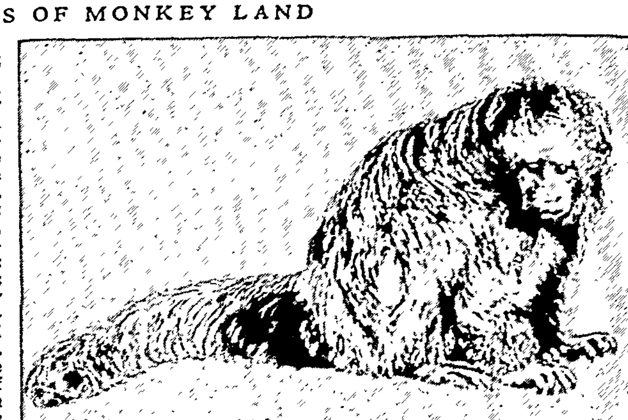
The big toe of most monkeys is exactly like a thumb, so that they can grasp objects with their feet as well as with their hands.

Even if a monkey cannot talk, he can tell you very plainly where he lived when he was at home—that is, whether he is an Old World monkey, from Asia or Africa, or a New World monkey from South America. The monkeys in a zoo always come to the netting when visitors appear, for they are very curious and want to see everything that is going on; besides, they have learned that some especially friendly little boys and girls carry bags of peanuts. Select any little fellow who comes up to you and give him peanuts, *one at a time, as fast as he can take them. If he is an* Old World monkey he will stow those nuts away in cheek pouches *like* a squirrel. He can put a surprising number away, for those pouches stretch and stretch like little rubber balloons. Look at him carefully. His nose, of course, is flat, but the two holes are near together. And when he goes up to a bar to eat his nuts, *he does not use his tail in climbing* or for holding on.

A South American monkey's nostrils are far apart. He has no cheek pouches, but heaps as many nuts as he can carry in his two front arms, as you carry packages. But he can keep other monkeys from taking his nuts when he climbs, for he uses his long curly-tipped tail *for a fifth hand.* With *five* hands for grasping, the South American monkey is a wonderful trapeze performer. The tree-squirrel climbs faster, the flying squirrel leaps farther, the bat clings better with his wing-hooks; *but no other animal can climb,* leap, *and* swing across a wide forest, 40 feet from the ground, the way the South American monkeys can. "The acrobats of the animal world," they seem to be made up of wire springs that are tireless.

SOME QUEER STYLES OF MONKEY LAND

On the left is a "White-Eared" Marmoset. You can see plainly why they call him that. He is a delicate timid little creature whose home is in Brazil. On the right is Humboldt's Saki, a native of the upper Amazon. His general color is black with a gray grizzle of white-tipped hairs mixed through the black. He looks as if he had upset a pail of whitewash on himself and was worried about it.

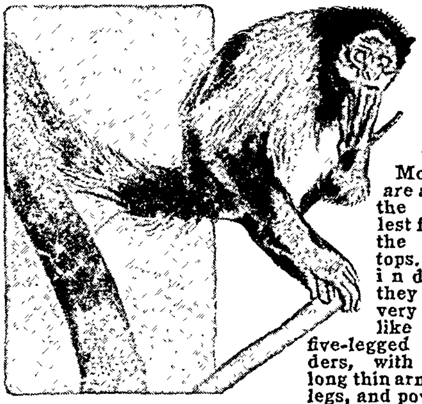


They do not leave the trees except in case of necessity, and they drink while clinging to a bough which overhangs the water. They feed on leaves, fruits, insects, eggs, the young of birds, and on honey. American monkeys seldom damage man's *productions*, but they are hunted for their flesh and fur.

The South American monkey that you see oftenest with the organ man is a small rusty-brown animal, about as big as a toy terrier. He has a curved hair-covered tail, good thumbs, a rather pleasant whistling chatter, and a careworn anxious face, as if he expected nothing in life but bad news. He is bright and obedient, so he soon learns his tricks and performs them willingly. He likes to ride on a dog's back, on his master's shoulder, or on the organ. Another favorite of the organ man's is the Capuchin monkey. You may know him by the queer way in which the hair grows around his face, like a hood or cowl of a Capuchin monk.

Sometimes in school you learn a rule, and then the teacher will tell you that there are times when the rule doesn't work. The marmoset, the smallest and prettiest of all South American monkeys, cannot use his tail in climbing. When children see the marmoset they always cry: "Oh, what a little dear!" He is no bigger than a chipmunk. He is only eight inches long, with a furry body and a foot-long bushy tail that he carries like a plume. If it weren't for his almost human little face and hands, and his winglike tufted ears, you might think him a squirrel.

A SOUTH AMERICAN "SPIDER"

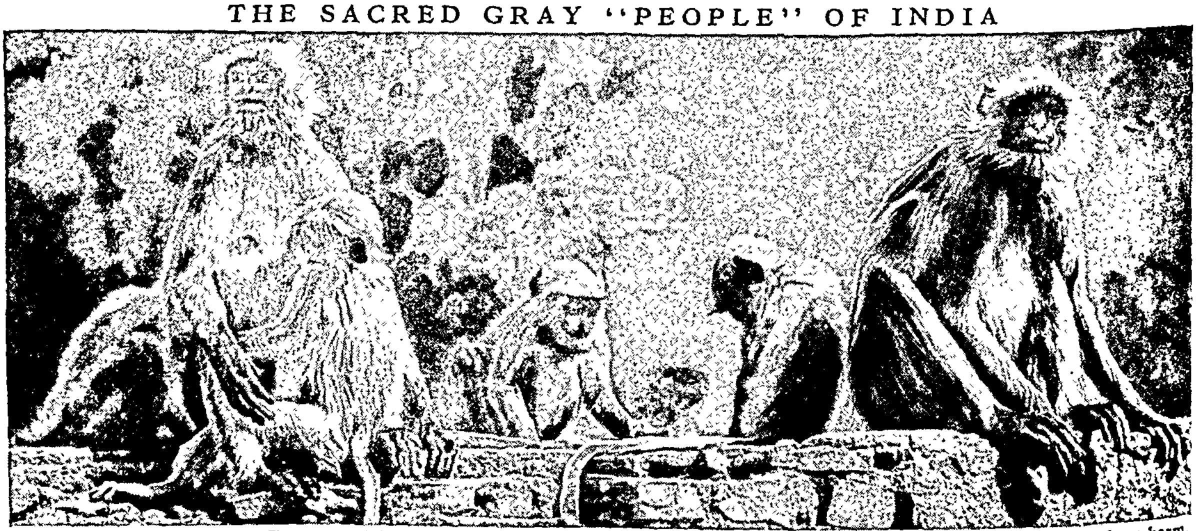


Spider Monkeys are among the nimblest folk of the tree tops. And indeed they look very much like huge five-legged spiders, with their long thin arms and legs, and powerful tail.

There is a squirrel monkey from South America only a little larger than his nut-cracking namesake. He has a gray face and a black nose, but has long hind legs, so that he leaps somewhat like a kangaroo. When he is happy he shows it by grinning, and when he is hurt tears come into his eyes. In his home in the Amazon forests it rains torrents sometimes, as if the bottom had fallen out of the clouds. When caught in such a storm a troop of these squirrel monkeys huddle together in the thickest tree they can find, and put their tails around each others' necks for company and comfort.

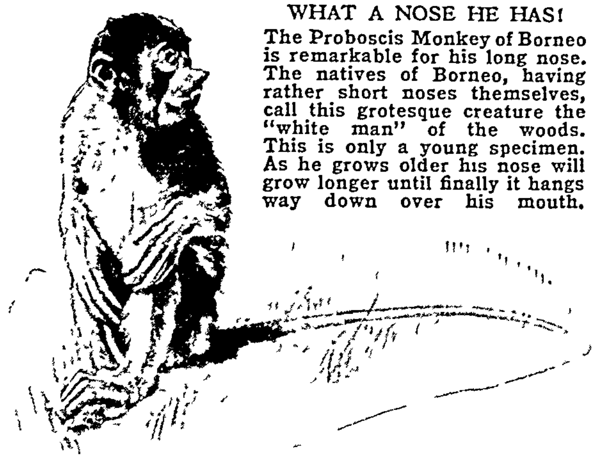
These marmosets and squirrel monkeys have some of the noisiest neighbors—the "howling" monkeys. They have a larynx or voice box with six pockets, which reflect the voice and give it unusual strength. They begin howling at sunrise, keep it up until the next sunrise, and then take a fresh start. The woods ring and echo with their howls. They travel all the time through the high branches of the trees, the males leading and the mother monkeys following, each with one or two babies clinging to her neck with fingers and tails. They swing by their tails and catch the next limb with a hand. The brown howler is bad enough, but the red howler makes the night hideous with his cries. They screech as if all the animals in the forest were eating one another up. Some zoos won't have little-old-man-howler, as he is called, at all. He disturbs the other animals, and is altogether too much of a nuisance.

THE SACRED GRAY "PEOPLE" OF INDIA



The Hindus look upon the Hanuman Monkeys as the living representatives of one of their gods, and so protect them from harm. The result is that these mischief makers gather about Hindu villages in family groups like this one, and live luxuriously off the farmer's crops. Sometimes when the Hanumans threaten to eat everybody out of house and home, the desperate villagers go out, and, with many apologies, capture the tame monkey folk and deport them far into the jungle, treating them meanwhile with the tenderest care.

Another South American monkey is the saki. He has a ruddy back, and an almost human habit of cupping a hand and dipping up water when he wants to drink. He is so delicate that he seldom lives long in captivity, so you may never see him. But you are sure to see the spider monkey. He has such long



WHAT A NOSE HE HAS!

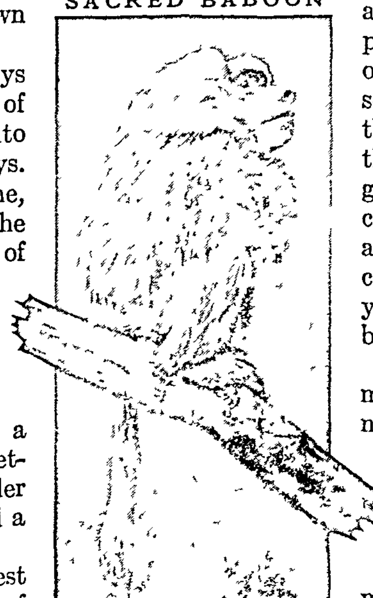
The Proboscis Monkey of Borneo is remarkable for his long nose. The natives of Borneo, having rather short noses themselves, call this grotesque creature the "white man" of the woods. This is only a young specimen. As he grows older his nose will grow longer until finally it hangs way down over his mouth.

slim arms and tail and such a small body that he looks like a big, hairy spider. But really he is very gentle and even affectionate. He has little stumps of thumbs, or no thumbs at all, and often uses his tail to convey food to his mouth. A mother spider monkey likes to sit down and cuddle her baby in her arms.

So many of the Old World monkeys have only little stubs and lumps of thumbs that scientists put them into one family of "cut-off-thumb" monkeys. If you see a monkey with a very fine, long-haired silky coat, particularly if he has cheek pouches and makes no use of his tail, look for shrunken little thumbs. His coat makes pretty monkey-skin collars and muffs. One monkey of the mountains of Abyssinia, where it is cold, looks as if he were wearing furs himself. He has a fringe of white down either side his jet-black velvet body, a white tippet under his chin, a white edge to his cap, and a white tip to his tail.

Another monkey of the hot west coast of Africa wears the hair on top of his head in a crest, with a parting on each side, something like the way grandma used to comb your papa's top hair, in a long fat curl called a "roach." This crested monkey looks very comical indeed, for besides his roach he has whiskers under his chin. A near neighbor of his in the African jungle is the "face-maker." He is a very good-tempered teachable little fellow. The variety of queer faces he can make always draws crowds, so he is always a great favorite with organ men, circuses, and zoölogical gardens.

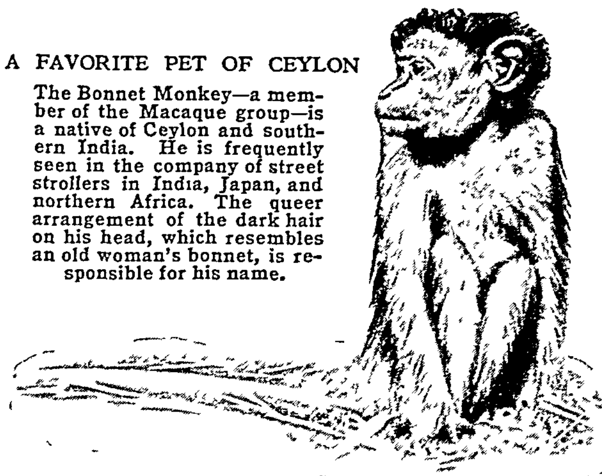
SACRED BABOON



Pictures of this dog-like creature are found in great numbers on monuments of the ancient Egyptians, by whom he was held sacred. He dwells mostly in Arabia and Abyssinia, and is also called the "Mantled" Baboon because of the long mane worn by the males.

A FAVORITE PET OF CEYLON

The Bonnet Monkey—a member of the Macaque group—is a native of Ceylon and southern India. He is frequently seen in the company of street strollers in India, Japan, and northern Africa. The queer arrangement of the dark hair on his head, which resembles an old woman's bonnet, is responsible for his name.



The guenon is the most sympathetic of African monkeys. It is commonly found in zoölogical gardens. It is a small graceful creature with fine hands, long thumbs and tail, big cheek pouches, and large hairless parts called callosities. It is a lively, merry monkey. It lives in troops under the leadership of an old, experienced guenon, and when a raid on a cornfield is made, this master leads, and the females follow, carrying their young. They travel in tree-tops until the field is reached and descend at a signal of the leader. The cheek pouches are quickly filled; then the rest of the crop is wasted in an attempt to select the choicest ears. If danger threatens during the raid the leader gives the signal for retreat, each mother grasps her child and as much corn as she can carry, and all take to the tree-tops again. With proper care they thrive in captivity and give tender care to their young and the weak and helpless members of their kind.

Among the brown and gray and black monkeys in a zoo, you will be sure to notice any that are brightly colored. There are a red- and a purple-faced monkey; a Diana monkey, with a pretty white crescent like a new moon on the forehead, a white beard and neck scarf; and a monkey with a blue mustache above yellow whiskers — he is called the "mustache" monkey. The green monkey, whose home is in the region of the Nile, is quite a dandy. He is dressed in dark green and black, set off with dull orange whiskers, throat band, breast-plate and tail-tip. He was introduced into the Lesser Antilles some 200 years ago.

At first sight the hanuman monkey of the East Indies doesn't look especially interesting. He is a little spider-legged animal three or four feet long, with cream-colored fur and black hands and face.

THE GROTESQUE MANDRILL

Mandrills are the largest and most violent of the baboons. In their home in West Africa they attain a height of three feet.

But he is a privileged being. In his native land he is sacred to Hanuman, a monkey-faced god. The Hindus have a legend that Hanuman, with the aid of a monkey army, helped rescue the wife of the divine hero Rama from a demon. Another legend is that Hanuman brought men a stolen gift, the mango, a valued Indian fruit. For the theft the monkey was doomed to death by fire; but it escaped with only its hands, feet, and face burned, and these have been black ever since. The Hindus are afraid to interfere with these monkeys, so the animals go freely in troops into the villages, help themselves to grain, fruits, and nuts in shops and houses, and destroy property in mere idle mischief. Stories are told of whole tribes of the hanuman monkeys swarming into dining rooms and eating wedding feasts. In some Hindu communities these monkeys live in the upper stories of the homes of the natives. If one native bears another a grudge, he places rice or corn on the enemy's roof during the rainy season. When the monkeys see this they eat the grain that is within reach, then tear up the tiles of the roof to secure the particles which have fallen into the crevices, and so the house is opened to the rain.

Another mischievous monkey is the magot, who lives in northwestern Africa and in Spain around Gibraltar. He is about as big as a terrier dog. Bands of these monkeys will go to a fine garden and set sentinels in trees and on rocks to watch, while the others eat and destroy melons, figs, grapes, oranges, and almonds. This habit lands many of them in zoos, because they fall into traps set for them on their forays. In the early days when naturalists and surgeons were forbidden to dissect human bodies, they learned much about anatomy by studying the bodies of magots.

KRA MONKEY WITH BABY

These kra monkeys of India are of the macaque group. Notice how the startled mother guards her little one.

The Macaque Group of Monkeys

Street strollers of India, Japan, and northern Africa lead about "bonnet" monkeys of the macaque (*mà-kăk'*) tribe. The bonnet monkey is sturdily built, with a short tail, and its hair grows in a frill around its face It is quick, clever, and mischievous. A relative of the bonnet monkey loves crabs and has learned to swim and dive for them. The pig-tailed bonnet monkey of the East Indian islands is captured and trained to climb up the tall palms and pick coconuts for its owner. Another favorite of street strollers, also a member of the macaque group, is the long-tailed kra of India. It is very clever and its expressions when registering fear, curiosity, gladness or anger are touching as well as extremely comical The rhesus monkey is the common macaque of northern India. Like the hanuman, it is venerated by the Hindus and makes a nuisance of itself with its boldness and its destructive habits. Some of the rhesus monkeys live in the high northern mountains, where they have acquired a thick undercoat of wool to keep them warm.

Borneo is the home of the long-nosed or proboscis monkey. The male has a long and beaklike nose, which can be moved in all directions. The fur is red, thick, and soft, and about the neck it is nearly a foot long, forming a heavy collar. The snub-nosed monkey of northwestern China and Tibet has a funny little snout that turns straight up in a point.

The least monkey-like of all the monkeys are the baboons. With their long muzzles and their way of walking and running they look more like large, hideous dogs. Their fierce and surly disposition matches their looks (*see* Baboon).

Monkeys are a bread and butter staple of the animal trade. The rhesus and the capuchin are the most common, retailing to zoos, pet stores, and scientific laboratories for $15 or $20. The woolly monkey of South America is considered expensive at $75, and as much as $200 has been paid for a colobus monkey from Africa. Among the rare species seldom seen in captivity are the giant spider monkey of South America, the proboscis, and the snub-nosed monkeys. One reason for this is the difficulty or impossibility of providing them with their natural food. Most zoological parks and pet stores buy their animals from importers, who in turn buy from natives. A few large-scale buyers have their own agents who go into the jungles and deal directly with the natives.

How Monkeys Are Classified

Monkeys fall into two distinct divisions—the *platyrrhine* or broad-nosed monkeys of Central and South America, and the *catarrhine* or narrow-nosed monkeys of Asia and Africa.

Catarrhine Division. Nostrils closely compressed, opening downwards; 32 teeth; many species terrestrial, spending much of their time on the ground; tails useless for grasping; most species with well-formed, opposable thumbs; callosities or calloused bare spots, often highly colored; either cheek pouches for the storing of food, or chambers in the stomach which serve the same purpose.

Platyrrhine Division. Widely-separated, out-flaring nostrils; 36 teeth; living entirely in trees; tail used for grasping by most species, serving as a fifth hand; thumb absent or undeveloped, not opposable and so unable to pick up objects; no callosities; no cheek pouches or stomach compartments. Marmosets differ from the other monkeys of this group in having only 32 teeth.

This distinction between the monkeys is one of the most singular and interesting mysteries in zoology. Apparently the differences have existed as long as there have been monkeys. No fossil remains intermediate between the two types have ever been found. Nor have fossils of one type ever been found in the hemisphere now inhabited by the other. They must, therefore, have originated from two separate stocks of ancestors. If this is true, however, it is hard to understand why they have not diverged further in structure and habits.

The New World or platyrrhine monkeys are the more primitive group. They compose the family *Cebidae;* marmosets belong to the family *Hapalidae.*

The Old World or catarrhine monkeys belong to the family *Cercopithecidae*, which is divided into two sub-families· *Cercopithecinae* and *Semnopithecinae.* The *Cercopithecinae* have cheek pouches and short tails. They include the macaques, baboons, magots, and guenons. The *Semnopithecinae* comprise the langurs, the guerezas, and the proboscis monkey. These have long tails and no cheek pouches

Monkeys fall into the order *Primates*, which is divided into three sub-orders. *Anthropoidea*, including man, apes, and monkeys, is the most highly developed. Below the monkeys in the evolutionary scale are the *Lemuroidea*, lemurs; and the *Tarsioidea*, tarsiers.

The Three Wise Monkeys of Japan

These are the three wise little Japanese chaps, who "see no evil, hear no evil, speak no evil." They are carved in an open grille panel above the door of the royal stable in the group of temples at Nikko, Japan. Their names are Mizaru, "see no evil" (at the right of the panel), Kikazaru, "hear no evil," and Iwazaru, "speak no evil." The intricate wood carving, delicately colored in shades of green, pink, peach, and brown, is the work of Hidari Jingorō (1594–1634), the great left-handed ("Hidari" in Japanese) artist who did many of the finest carvings at Nikko.

The Three Mystic Monkeys, known in Japan as the Sambiki-saru, represent Buddhist teachings on the three principal temptations. The idea is very old, for the three monkeys are represented in ancient Japanese statues showing Hindu influence; they appear on the headdress of one of the ancient deities. The Sambiki-saru are associated with the long-nosed Shinto god, Saruta Hikō, and they are the attendants of the Buddhist Kōshin, god of the roads, who is depicted as a monkey-headed man.

The stable at Nikko houses the sacred white horse, kept for the use of the gods in the temple of the great shogun Iye-yasu. It has long been the custom in Japan to keep a monkey in the imperial stable to entertain the horses. Horse and monkey are associated, moreover, in Japanese mythology. They represent human feeling and human thought, expressed in the old proverb, "The heart is like the monkey, while the head is like the horse."

LIFE *in* CELL *and* CLOISTER

Near the River Tweed in Scotland lie these weathered ruins of Melrose Abbey, one of the most notable monasteries. It was founded in 1136 by the Scottish king, David I, as a monastery for monks of the Cistercian order. Here the white-robed monks worked and prayed, sheltered travelers, and aided the poor and aged and sick. But during the Scottish border wars the abbey was frequently stormed, and destroyed in 1322. It was soon rebuilt, but again left in ruins in 1545. Sir Walter Scott celebrated the abbey in the 'Lay of the Last Minstrel'. The great stone walls of Melrose Abbey shelter the graves of Scottish kings and earls. The heart of Robert Bruce is believed to rest near the high altar.

MONKS AND MONASTICISM. The word "monk" (from the Greek *monachos*) originally meant a solitary, or one who lives alone, but in course of time it came to mean a member of a religious community. Similarly the word "monastery" meant a cell or hut, and then came to mean a community of men or women devoted to the service of God and obeying a fixed rule. In the early days of Christianity there lived in the great Egyptian desert called the Thebais numbers of solitaries or "hermits" (from the Greek, *eremites*, "a dweller in the desert"). The most celebrated of these was Paul of Thebes, who lived 112 years in the 3d and 4th centuries. These hermits were remarkable for their self-denying or "ascetic" mode of life.

The first monastic organization dates from the year 305, when Saint Anthony established a monastery at Phuim, on the banks of the Nile. This, however, was not a monastery in the strict sense, as the brethren lived in separate huts, and though under Saint Anthony's direction, they lived a life which was largely suggested by individual spirit. The first community of monks living under a common roof was established by Pachomius in the year 340, at Tabenna, an island of the Nile. He compiled the first monastic rule. The difference between the monks under the guidance of Saint Anthony and those under the direction of Pachomius was chiefly this, that the former spent all their time in the reading of the Scriptures, in prayer, and works of mortification; while the latter led an active life in which religious exercises and the reading of the Scriptures alternated with daily labor in the fields.

This picture, like others in this article, is reproduced from ancient drawings made by the monks themselves. It shows a Benedictine of the Middle Ages. Hard work was the guiding motto upon which was founded the Benedictine order. Its members were formerly known as "Black Monks" from the color of their robes.

From Egypt monasticism spread into Asia Minor and Syria; and about the year 360 Saint Basil established a great monastery near Neo-Caesarea, in Pontus. He is regarded as the founder of Eastern monasticism, of which the famous monastery at Mount Athos is the modern representative. Saint Basil laid down the principle that the monk must not live for himself alone, but must do good for his fellow-man. In order to give his monks an opportunity to put this into effect he established hos-

pitals, hospices, and orphanages near the monasteries under his care. He also provided schools for the education of boys, not necessarily with a view to their becoming monks. He discouraged excessive asceticism, and taught that work is of greater value in the monastic life than self-imposed mortifications or punishments. Accordingly, the time of the monks was divided between prayer, good works, and the reading of the Scriptures.

Monasticism was imported into Italy directly from Egypt at an early date, and monasteries of men and women soon became numerous throughout the Italian peninsula, especially in the neighborhood of Rome. Thence it spread into Gaul, where Saint Martin of Tours founded the monastery of Ligugé, near Poitiers, in 360. Even more celebrated than Ligugé was the monastery of Lérins, which gave to the church of Gaul some of its famous bishops and saints. Saint Patrick, the Apostle of Ireland, was trained there. There is little known of Spanish monasticism before the close of the 5th century; but there were many great monasteries in Wales and Ireland, each with many hundred monks. Undoubtedly the chief glory of Celtic monasticism is its missionary work, the results of which are to be found all over northwestern Europe.

The Cistercians, or "White Monks," were established under rules even more austere than the Benedictines. The Trappists, a later branch of the order, are noted today for the privations to which they subject themselves.

The greatest name in the history of western monasticism is that of Saint Benedict of Nursia, who was born about the year 480. His 'Rule' set forth the details of the monastic life in a way that had never been done before. According to Saint Benedict's idea, the great disciplinary force for human nature is work; idleness is its ruin; work is the first condition of all growth in goodness. And prayer too is a kind of work, for grace meets with no coöperation in the heart of the idler. When the Goth went to visit Saint Benedict in his monastery at Subiaco, he gave him a bill-hook and sent him to clear away briars to make a garden. "Go and work," was his advice. He taught that work is not the duty of slaves; it is the universal lot of mankind, necessary for his well-being as a man, and essential for him as a Christian. The religious life as conceived by Saint Benedict is essentially social, where prayer alternated with social duties.

The influence of Benedictine monasticism was evidenced in many ways during the Middle Ages—in the conversion of the barbarians and the civilization of Europe; in the development of agriculture, for it has truly been said by a great historian that the Benedictines were the agriculturists of Europe; in the cultivation of learning and the teaching of crafts and trades, such as painting, wood carving, working in metals, carpentry, weaving, tailoring, the tanning of leather, and clock-making. English Benedictines were the greatest clock-makers of the 14th century; and one of the most wonderful clocks ever devised was the work of Peter Lightfoot, a Benedictine of Glastonbury. This clock, now in the South Kensington Museum in London, was formerly in the tower of Wells Cathedral in Somersetshire.

Nearly all the great orders of the Middle Ages were founded on the Benedictine plan, though differing in certain details. The most notable of these were the Carthusians, so called from the Grande Chartreuse near Grenoble, in France, founded by St. Bruno in 1084; the Cistercians, or "White Monks," founded by Saint Robert Molesme, in 1098 (a later branch is called Trappists); and the Premonstratensians, or "White Canons," named from Premontré, in France, founded by Saint Norbert in 1120. The Benedictines were formerly known as the "Black Monks," from the color of their habit.

The monasteries were all self-contained communities and as a rule were divided into abbeys and priories, of which the abbey church was the central figure. Around this were the many buildings which formed the monastic compound. The English word "minster" comes from the Latin word *monasterium* through the Anglo-Saxon word *mynster*. It is used in such titles as Westminster Abbey and York Minster.

In all monastic churches the plan was governed by certain common necessities: (1) A choir had to be provided for the chanting of the "canonical hours" by the monks. The canonical hours are fixed forms of prayer which every Catholic priest is bound to recite daily—matins, lauds, prime, tierce, sext, none, vespers, and compline. (2) A sufficient number of altars was necessary, so that the priests of the monastery might be able to celebrate mass at fixed hours. (3) Arrangements had to be made for processions which were held every Sunday.

Next in importance to the church was the cloister, which, as its name implies, was an inclosed space, surrounding all four sides of a rectangular court known as the "garth." The four walls of the cloister were roofed in. Here the older monks labored at appointed duties, such as the copying of manuscripts and writing; here, too, the younger members of the community toiled at their studies under the direction of teachers. Then came the refectory, or as it is called the "fratry"

or common dining-hall, which was always located at some distance from the church. The floor of the refectory was covered with straw or rushes changed three or four times in the year. Close to the refectory was the kitchen. The dormitory usually was near the cloister. In early times it was simply an open apartment without screens. Later, partitions were introduced, and each monk had a small room where he studied as well as slept.

A most important feature of every monastery was the infirmary, or house for the sick and the aged. It was placed near the dormitory and close to the garden, or "herbarium," where herbs used in compounding medicines were cultivated. The care of the sick was especially enjoined upon the superior of every monastery by the Benedictine Rule. A guest-house was a necessary part of the establishment; and near the gate of the monastery there was invariably a shelter for travelers. Every religious house had an almonry, or place where the poor could receive alms, in the name of Christ. To the almonry was usually attached a free school for poor boys. Near the cloister there was a common-room or "calefactory" (warming place) where the monks might resort in winter to warm themselves at the common fire, which was lighted on the Feast of All Saints, November 1, and kept burning daily till Easter.

The Carthusians, except on special occasions, eat but once a day and then of the coarsest food. To mortify the flesh they wear rough hair shirts. They live in separate little houses like the ancient monks of Egypt, and spend their time reading, praying, and laboring with their hands.

Libraries as we know them today were not found in the old monasteries; but manuscripts and copied books were carefully preserved in lockers or cupboards in the church or in the cloister. By the 15th century, however, libraries were common, many of them very large and splendidly arranged, with "cubicles" or small writing rooms. In addition to the foregoing parts of the monastery there were numerous buildings set apart for various kinds of work, such as carpenter shops, book binderies, forges, mills, bake-houses, and barns. All of these were under the supervision of a chamberlain, or procurator.

All the inmates of a monastery were under the government of an abbot (from the Latin *abbas*, "father"), whose authority was supreme. Next came the prior; and then his assistant, the sub-prior. There were several officials known as *obedientaries*—such as the cantor, or singer; the precentor, or chief librarian and archivist; the cellarer, or bursar; the refectorian; the kitchener; the infirmarian; the almoner; the chamberlain; and the novice-master. The position of abbot was one of great power and influence.

The daily life of a monastery was minutely ordered. The day between sunrise and sunset was divided into 12 equal parts or *horae*, and likewise the night, or from sunset to sunrise, into 12 equal *horae*. The hour for rising was about 2 a.m. On rising the monks went to the church, or oratory, for the vigils or night office, matins, and lauds. Meditation and other prayers followed. Prime was said at sunrise, after which they went to their appointed work till 10 o'clock. Tierce was then said; and from 10 till 11:30 they read. Then sext was recited; followed by dinner, which was over shortly after midday. The dinner, or *prandium*, consisted of vegetables, possibly eggs, perhaps fish, salad, bread and wine; but no meat was allowed. In Italy there followed a *siesta* or afternoon nap; but elsewhere the monks went to the fields, the shops, or the bakehouse and worked until vespers at 5 o'clock. Supper, or the *coena*, was at 5:30; then the reading of the "collations," and compline, and to bed at 6:30, often while it was still daylight.

We must distinguish "monks" from "friars" (from the French *frère*, "brother") though both are called Religious Orders, or "Regulars," as distinguished from the "Secular" clergy. Seculars are not bound by the vow of poverty as are Regulars; they follow no special rule, and may hold property as individuals. Retirement from the world and solitude are the essential characteristics of monks; hence it is that monasteries are located away from cities or towns in some secluded spot. Friaries are usually found within or near city limits, as the friars engage in parochial and other ministerial work, and come in close contact with the outside world. Friars originally depended on alms or offerings of the people for their subsistence; hence the term mendicant (from the Latin *mendicare* "to beg") was formerly applied to them. The chief orders of friars are the Dominicans ("Black Friars"), the Franciscans ("Gray Friars"), Carmelites ("White Friars"), and the Augustinians.

Among these the Franciscans are perhaps the best known in American history, for it was the Spanish members of that order who founded the many early Indian missions in the New World, penetrating Arizona and New Mexico as early as 1539. (*See* Francis of Assisi.) The Dominican friars form a preaching and teaching order, with many communities in America.

It may be asked why men and women leave the world to enter a religious community. Briefly, a

THE VESPER HOUR AT THE MONASTERY

What poet could better express the serenity and quiet beauty of the monastic life than the camera has here done in this view of a venerable monk among the graves of the dead at the vesper hour in the Franciscan mission of San Luis Rey, California?

THE LIFE OF TOIL AND PRAYER

Like the Benedictines, the Cistercians keep their time well occupied with toil, particularly as farmers and gardeners, both orders believing that idleness is a great source of evil.

Catholic believes they do so the better to practice the counsels given by Christ as set down in the Gospels—the renunciation of wealth, worldly pleasures, ambition or self-seeking, and the rendering of greater service to God and humanity. These are the motives which have induced and still induce multitudes to embrace the "religious" life.

In the early days of Christianity women vowed to the service of God lived in their own homes, and at a later period in community houses called *parthenones*. Not till the institution of monasticism did they live according to established rule. Thenceforth they are known as "Nuns" (from the French *nonne*, supposed to be derived from an Egyptian term meaning "virgin"). The nuns of Egypt and Syria cut their hair—a practice not introduced in the West till a later period. In the early Middle Ages there were many communities of nuns in France, Italy, Spain, England, and Ireland, whose organization was, with a few exceptions, similar to that of monks. Heading each community was an "abbess," who, like the abbot of the monasteries, had complete jurisdiction in matters of administration.

A CLUNIAC MONK

The order of Cluniac Benedictines was founded in 910. In place of the manual labor of the Benedictines, this order substituted prolonged church services.

Those who enter a religious community, whether of men or women, must first become "postulants." Then follows a "noviceship," the period of which differs for various communities, but it must not be in any case less than one year. Following the novitiate comes the "profession," which is either simple or solemn. At the solemn profession the religious takes the three vows of poverty, chastity, and obedience. The constitution of an order may add other vows or rules inspired by its purpose. Thus the Poor Clares make a special vow of enclosure; the Minims make a vow of strict abstinence; the Carmelite sisters and "Discalced" (barefoot) Augustinians, a vow of humility; the Passionists, to promote devotion to the Passion of Our Lord; the Brothers of the Christian Schools, vows of stability and gratuitous education of children; the Little Sisters of the Poor, a vow of hospitality.

MONOPOLIES AND CARTELS. Almost any community has various monopolies operating within it. The electric-light company and the United States Post Office are two examples. The owner of a town's huge factory also may exercise a monopoly. The distinguishing feature in every case is that the person, company, or institution has *exclusive control of the supply of a commodity or service.*

The electric-light company represents the most common type of monopoly. The installations needed to generate and distribute electricity for light and power are extremely costly. Most communities therefore entrust the business to one company under a *franchise* which gives the company a monopoly and provides for regulation of the company's rates and services. This avoids costly and wasteful duplication of facilities.

The United States Post Office is an example of a *public* monopoly. Governments create and operate monopolies to provide revenue or because this seems the best way to provide service. *Legal* monopolies are created when the government grants patents or copyrights to inventors, authors, and others.

The large factory may typify a *capitalistic* or *private* monopoly. It may dominate the supply of a commodity or service by controlling raw materials, through arrangements with other companies, or by having surpassed or extinguished competition.

Price Problems Created by Monopolies

Any person or organization which has exclusive control of a commodity or service can fix the price or charge for it, within certain limits. One limit exists where the charge is fixed or regulated by public authority. Another kind of limit is set for private monopolies by public willingness to pay.

Very few commodities and services are completely indispensable. If the price asked for them is too high, the public turns to substitutes. But this buying resistance may not become effective unless the price is fixed far above a fair and reasonable charge. Below this limit, extortionate profit is still possible.

Effects Upon Progress and Development

If the persons in control of a monopoly follow a policy of continual improvement in operations and product or service, the monopoly can make notable contributions to progress. Usually it can support expensive research and improvements, and achieve marked economies in distribution costs. And to discourage competition, it may seek a large volume of sales at a moderate profit on each unit sold.

The opposite course, however, is also open. The management may elect to operate without improvements and obtain its profit from its control of the market and (within limits) maintaining high prices. Such a choice may close the door to progress in the field. A related danger lies in the field of politics. An unprogressive monopoly might use improper or corrupt means to defeat legal action against it.

Rise of Monopolies in the United States

In the latter half of the 19th century, monopolies arose in the United States as an inevitable result of changes which were occurring. The industrial revolution, with its changes from hand work to machines and from muscle power to steam power, was at its height (*see* Industrial Revolution). Railroads and steamships were taking over the nation's transportation. At the same time, inventors were creating new public services such as the telegraph and telephone, gas and electric light, and streetcars.

But all these developments needed large sums of money to pay for the machinery and necessary installations; and money could be raised only if the enterprise could expect large earnings. No one would provide a million dollars to equip a steel plant unless sales in the millions could be expected. A telephone company would not be a practical venture, unless a large number of subscribers was in prospect. Otherwise the service would be of limited value, while rates would have to be exorbitantly high to cover installation and operating costs.

Rise of Private Monopolies

Thus "bigness" became a necessary part of American business enterprise in many fields; and from this came inevitable tendencies toward monopoly. In fields where large investments were necessary to achieve machine-age efficiency, competition necessarily lay between a relatively small number of companies. It became fierce and often ruinous, and many evil practises arose.

One of these evils was selling below cost. A strong company might do this in some market to drive out competitors and win the entire market. Powerful companies also gave their railroad freight shipments to roads which in turn would give them the most favorable rebates. And inevitably, various persons and groups sought to ease the strain of competition, and at the same time win a huge market with assured profits, by acquiring monopolies in various fields.

Rise of the Monopolistic Trusts

The first private monopoly which attracted widespread attention was the Standard Oil Company. It was organized in 1870 by John D. Rockefeller and his associates. By ruthless use of the competitive methods of the time, they gained an almost complete monopoly of the petroleum refining industry (*see* Rockefeller, John Davison). In 1882 they organized the enterprise as a *trust* (*see* Trusts).

Other monopolists saw advantages in this plan and followed suit. At once the public began using the word "trust" to mean monopoly. Soon people were talking of the tobacco trust, the sugar trust, the steel trust, and the meat trust, regardless of whether an actual trust existed.

Early Laws to Curb Monopolies

These developments aroused public demand for protection against the threat of exploitation by monopolies. In 1890 Congress passed the Sherman Antitrust Act. This law stated in its first section: "Every contract, combination in the form of *trust* or otherwise, or conspiracy, in restraint of trade or commerce among the several states or with foreign nations, is hereby declared to be illegal."

This sweeping language was intended to cover not only trusts of the Standard Oil type, but various other monopolistic devices. The simplest was the *merger* of several companies into one. Another device was the *holding company*. It held shares of stock in companies which normally would compete, and compelled them to act together. In an *interlocking directorate*, the same men would be directors in several companies, thereby assuring concerted action. Less formal were *pools* and *gentlemen's agreements*. The companies in a pool or an agreement might divide profits according to a schedule, regardless of which companies earned them, and thus destroy incentive to compete.

The provision against trusts quickly ended use of these monopolistic practises. The Standard Oil Trust was broken up in 1892, and in its place appeared the Standard Oil Company, incorporated in New Jersey. President Theodore Roosevelt had the government institute many antimonopoly suits. This was commonly called his "trust-busting crusade." In 1911 the government won a Supreme Court decision ordering dissolution of the Standard Oil Company of New Jersey. The decision held that the company had acted "in restraint of trade," but ordered dissolution only because the restraint was unreasonable. This "rule of reason" created added burdens of proof for antimonopoly action.

Shifts in Public Feeling and Action

By this time the public, Congress, and the courts began to discriminate more clearly between problems arising from "bigness" and those concerning monopoly. An example of an earlier misconception had been the popular belief in the existence of a "beef trust." Actually, a few companies had come to dominate the meat-packing industry, and smaller ones seemed threatened with extinction. But the companies had always competed with each other. There had never been a "trust"—that is, a combination exercising a monopoly.

Another distinction which became clear lay between so-called *horizontal*, *vertical*, and *circular* combinations. Horizontal combinations drew together companies doing the same kind of work. If pushed far enough, such combinations could become monopolies. A vertical combination drew together successive steps in the same field of operation. A shoe manufacturer might buy a tannery to assure a supply of leather and a chain of stores to sell the shoes. Such combinations often were desirable, since they could increase efficiency and cut costs. A circular combination drew together dissimilar activities which nevertheless could coöperate effectively. A soap manufacturer might buy a margarine company which also used vegetable oil, and a company which produced oil.

Course of Later Legislation

In 1914, during the first administration of President Wilson, Congress sought to strengthen the Sherman Act by passing the Clayton Act. This law forbade restraint of trade by unfair price discrimination, and interlocking directorates or holding companies which might tend to "lessen competition or create a monopoly." The law specifically exempted combinations of labor such as labor unions from its provisions. Another act created the Federal Trade Commission, with power to forbid unfair business practises, whether or not they were monopolistic (*see* Federal Trade Commission).

Many suits and Supreme Court decisions distinguished illegal from legal practises. Several shifts of policy occurred under President Franklin D. Roosevelt. The National Industrial Recovery Act of 1933 permitted *marketing agreements*, which would have been considered monopolistic earlier. This act was declared unconstitutional in 1935. Thereafter the government prosecuted many antimonopoly suits, but during the second World War promoted coöperation in the war effort (*see* Roosevelt, F. D.). After the war, monopoly became part of the greater problem caused by scarcities of goods and rising prices (*see* Truman). A 1950 amendment tightened the Clayton Act by forbidding purchase by corporations of assets, as well as stock, of competitors if this reduced competition.

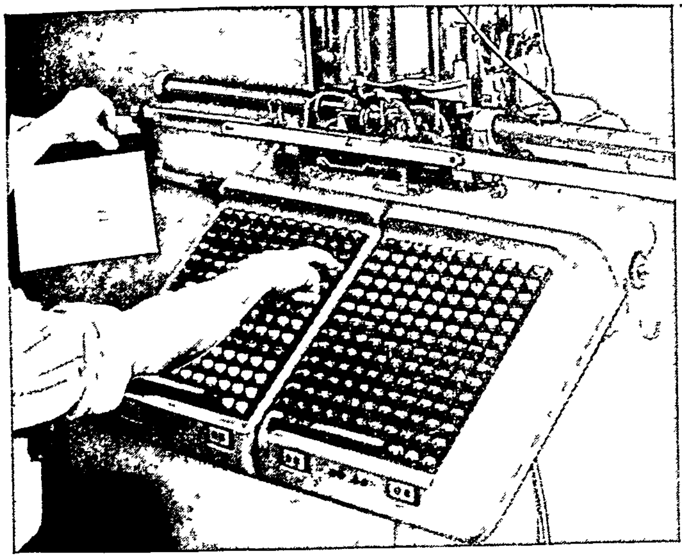
Combinations and Cartels in Europe

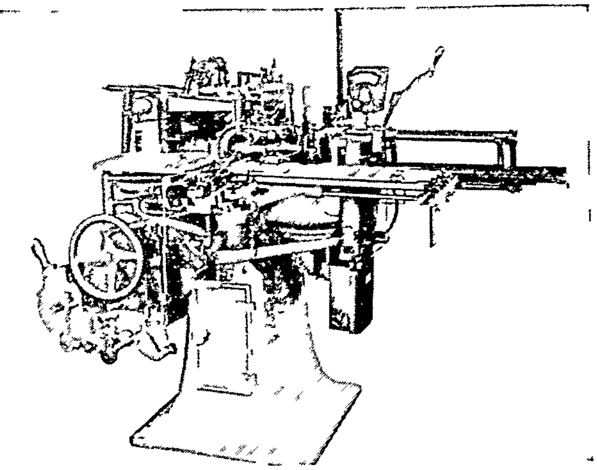
Monopolistic practises have appeared in many forms in Europe. The most common type is the horizontal combination within a single field. The *combine*, as it is called in England, or *cartel* as it is known on the Continent, is usually a loose pool that uses methods exactly like those which caused trouble for the early American trusts. The members agree that each shall produce just so much; shall sell it at a certain top or bottom price; and often agree as to an allotment of markets. Belgium, a highly industrialized nation, saw its first cartel in 1841, in coal. The original German cartel was formed in 1884 by agreement among four potash companies. Great Britain's first great trust was an outcome of the American tobacco war in 1901. This was the British-American Tobacco Company, one of the first foreign cartels in which American capital was interested.

A far-reaching type of European combination is the *international* cartel, formed to control competition for export markets. Patents, trade-marks, secret processes, especially in the chemical industries, are factors in bringing together the various countries into such agreements. The home market, as a rule, belongs to each country; in the allotment of foreign markets consideration is given to factors such as distance and transportation costs, previously established trade relations, and commercial treaties. A country with colonies will naturally have prior trade rights in those possessions.

Great Britain, Germany, France, and Belgium formed the first international cartel in 1884, for the control of steel rails. At first the Americans were at a disadvantage, because the Sherman Act and the Clayton Act forbade such combinations, but, under the Webb-Pomerene Act of 1918, they were permitted to join such combinations for foreign trade. Following the second World War Germany's part in these international trade combinations was stopped by Allied control of the country.

How the MONOTYPE *Machines* SET TYPE





These two machines work together to set lines and columns of Monotype. At left is the keyboard composition machine that produces a coded paper ribbon. At right is the automatic caster that molds type as indicated by the ribbon.

MONOTYPE. For centuries after Johann Gutenberg made printing from movable type practical, printers still set type by hand. They gathered type, piece by piece, from cases and set them in lines and columns. After using the type on the printing press they carefully redistributed it to the cases. This work was slow. The type faces wore down unevenly after several such press uses, and more type had to be purchased from special type foundries.

Finally in the 1880's two devices were invented to relieve the tedious hand labor and to provide new type for each use. One device was the Linotype, which casts a line of type on a solid metal bar (*see* Linotype). The other was patented in 1887 by its inventor, Tolbert Lanston, a government clerk. Lanston called his machine the Monotype, because it casts individual pieces of type.

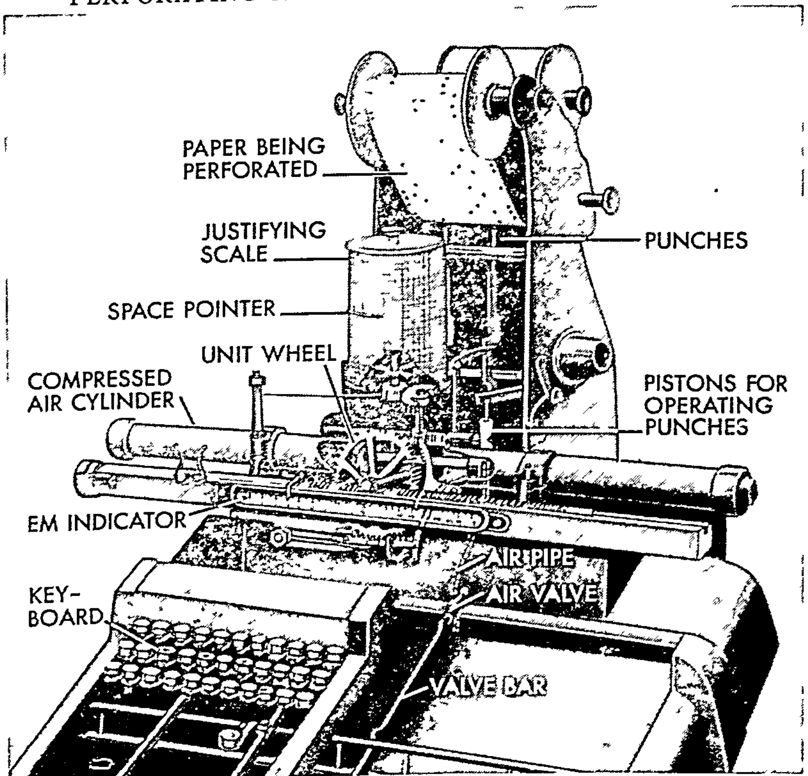
What the Monotype Does

The Monotype actually is two machines—a keyboard composing machine and an automatic typecaster. Both these machines are shown in the pictures at the top of this page. The keyboard may have five or seven alphabets, each arranged something like a typewriter keyboard. The seven alphabets permit setting type in these styles: roman capital (upper case) letters, roman small capitals, roman lower case, italic capitals, italic lower case, boldface capitals, and boldface lower case. Many different sizes and kinds of type can be set in these various styles.

The keyboard operator's task is to convert the *copy* (the material to be set in type) into a series of perforations on a paper ribbon. Then this ribbon, attached to the automatic Monotype caster, acts as a code to guide the machine so that it produces the correct type characters in the proper order.

In front of the keyboard operator is the copy and a plan, or *layout*, showing how the type is to be arranged. Following these, the operator "types" out the material on the keyboard. Working through a complex system of pistons operated by compressed air,

PERFORATING RIBBON ON KEYBOARD COMPOSER



On this simplified diagram most of the keyboard is cut away to show the action of a single key. It works through air pipes and pistons to operate a punch that perforates the ribbon. The unit wheel counts the spaces being consumed; this count is shown by the space pointer on the justifying scale.

the machine responds to the operator's touch by punching perforations in the paper ribbon. Each key controls a particular combination of perforations made by no other key. The paper ribbon is 4⅜ inches wide and is long enough to hold about 40,000 sets of perforations.

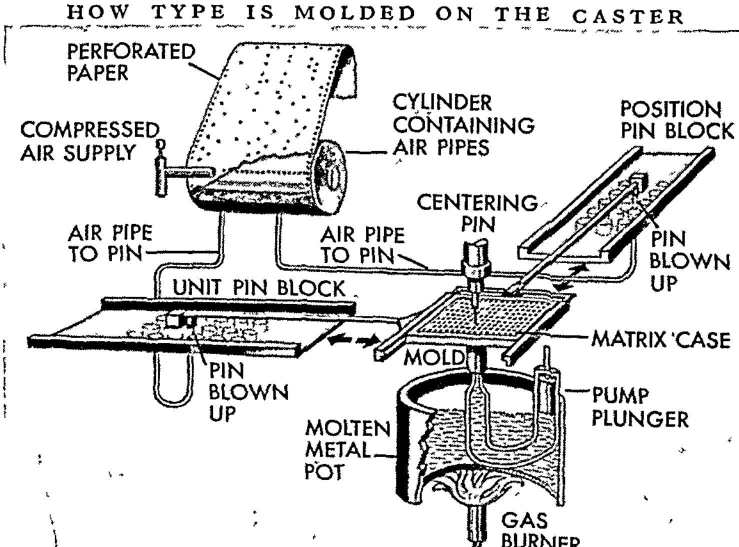
Whether type is set by hand or by machine, each line must be *justified* as it is set. This means that the line must be spaced out to its exact designated width so as to present an even right-hand margin down the column or page. The Monotype keyboard justifies each line by keeping count of the number of units each character and space consumes. Near the end of the line, a warning bell sounds. The operator notes the space pointer on the justifying scale to see how many units remain to be filled in the line. If there is no more room for the next word or syllable, the operator punches the justifying keys on the keyboard. These keys provide for additional spaces between words that fill out the line.

How the Monotype Caster Works

The heart of the Monotype caster is the matrix case, containing the brass matrices that serve as molds for the faces of the type characters. For a five-alphabet keyboard ribbon the case contains 225 matrices arranged as a square, 15 to a side. For a seven-alphabet ribbon the case contains 255 matrices, arranged as a rectangle, 17 on the long side, 15 on the short side. Each size and style of type face has its own matrix case. The cases, small enough to be held in the hand, are interchangeable in the caster.

The caster has two main actions. First, guided by the ribbon, it centers the proper matrix in the case over a mold for the type body. Then the caster forces molten metal from the melting pot up into the combined matrix and mold to cast the body and face for a complete type character.

HOW TYPE IS MOLDED ON THE CASTER



Here, in greatly simplified form, is the action of the Monotype caster. Notice how the perforated ribbon passes between the compressed air supply and the cylinder. Only two of the cylinder's 31 air pipes are shown leading to the pin blocks. These blocks center the matrix, ready for casting a type character.

To start the caster, the operator inserts the matrix case and attaches the ribbon. The ribbon runs between a tube supplying compressed air and a cylinder containing 31 air pipes. As a set of perforations in the ribbon fits over corresponding holes in the cylinder, compressed air floods through a set of two air pipes. This directed supply of air works through a set of pin blocks. The pin block mechanism moves the matrix case so that the proper matrix is centered over the mold. A pump plunger forces molten metal up from the pot into the mold and matrix. The cast type is then water-cooled and sent to a galley. There the type accumulates into lines and columns. The machine can cast as many as 160 characters a minute.

One remarkable feature of the caster is that the mold for the type body automatically adjusts in size for each letter. It makes a wide body for an "m" and a narrow one for an "i." Sometimes for appearance or for readability letters as well as words must be spaced out. The caster automatically performs this letterspacing by molding comparably wider bodies for all letters.

Advantages of the Monotype

As we have seen, automatic typesetting machines work more swiftly than a man can set type by hand; in addition they provide new type for each use. After the type has been used, it can be remelted to make new type. The Monotype has certain additional advantages over other typesetting machines. Because it sets individual type, single characters can be substituted by hand. This makes it especially useful for revising statistics and other numerical data in tabular form. Figures that become outdated can be easily corrected by changing only the individual number characters that are wrong.

Individual type characters also permit small adjustments in spacing between letters, words, and sentences. Such changes, made by hand after the type is set, result in a printed page that pleases the eye. The composition of Monotype metal produces an especially clean, sharp type face. Compton's Pictured Encyclopedia is set in Monotype.

A Monotype ribbon can be stored and used over again if the same material is to be reset. The caster itself can mold assortments of styles and sizes (or *fonts*) of type, ready to be distributed to cases. This type is used for hand-set jobs or for making hand corrections in machine-set Monotype. It can set rules and borders (horizontal and vertical lines) as well as type characters.

Monotype keyboards and matrices are made for setting many different alphabets besides our Roman system of letters. These other alphabets range from ancient Hebrew to modern alphabetical Chinese. (*See also* Printing; Type and Typography.)

MONROE, HARRIET (1860–1936). As a writer and poet herself, Harriet Monroe, a Chicagoan, saw that poets had little chance to win recognition and financial support. Few books by living poets were published, and magazines bought poetry mainly to fill left-over space. Miss Monroe determined to start a poetry magazine. With a small circulation she knew that the publication could not pay its own way. However, she wanted to pay poets for their work and, in addition, offer prizes. There was only one way to accomplish all this. Well-to-do people would have to support the magazine as they supported such similar cultural activities as orchestras and art museums.

HARRIET MONROE

Miss Monroe won lasting fame as founder and editor of *Poetry*.

By persuading about 100 Chicagoans to pledge $50 annually for five years, Harriet Monroe raised enough money to launch *Poetry: a Magazine of Verse* in 1912. She became its first editor. As its motto she chose a line from Walt Whitman: "To have great poets there must be great audiences too." Since its founding *Poetry* has published the work of virtually every notable American and British poet of modern times. Some now-famous poems that first appeared in the magazine are Carl Sandburg's 'Chicago', Joyce Kilmer's 'Trees', and Vachel Lindsay's 'Congo'.

Harriet Monroe was born Dec. 23, 1860, in Chicago, Ill. Her father was a well-known attorney and the family, which included four children, lived comfortably. Harriet completed her education at a convent boarding school in Georgetown, now part of Washington, D.C. During her 20's she enjoyed the life of a society girl with artistic and literary tastes.

Her father lost most of his money, and thereafter she earned her living by newspaper work and occasional contributions to magazines. A commission to write a dedicatory ode for the World's Columbian Exposition in Chicago brought her a fee of $1,000. Without her permission a New York newspaper published the ode before its public reading. Miss Monroe sued and was awarded $5,000. The judgment established a legal precedent regarding authors' rights to control their own works. Her other work paid enough to permit wide travel, and on these trips she enjoyed mountain climbing. Miss Monroe never married. She continued as editor of *Poetry* until her death on Sept. 26, 1936, at the age of 75.

The PRESIDENT *Who Said to Europe:* "HANDS OFF!"

MONROE, JAMES (1758–1831). As the president who first announced the principle known as the "Monroe Doctrine," James Monroe, the fifth president of the United States, holds an important place in American history. The idea of the doctrine that "America is for the Americans" did not however originate with Monroe. George Washington, in the wars between England and France, had publicly warned the nation to "beware of entangling alliances," and Thomas Jefferson had privately declared, "The day is not far distant when we may formally require a meridian of partition through the ocean, on the hither side of which no European gun shall ever be fired, nor an American on the other." It was left to Monroe, however, to make this doctrine of "hands off" for Europe a matter of official record by incorporating it in a message to Congress in 1823. (*See* Monroe Doctrine.)

Although the Monroe Doctrine is still part of the United States foreign policy, Monroe the man is little known, and his other achievements are almost forgotten. He was tall but so inclined to stoop that he looked shorter than his full height of six feet. His features were rugged and his awkwardness and shyness added to the unfavorable impression that he gave. He never overcame this appearance of timidity.

James Monroe was born April 28, 1758, in Westmoreland County, Va. His family, of Scotch and Welsh descent, belonged to the class of small planters of western Virginia. James attended a private school and at 16 he entered the College of William and Mary. The start of the Revolutionary War soon interrupted his education. With a number of classmates and instructors he left school to join the patriot army.

After serving for a time as a cadet, Monroe at the age of 18 became a lieutenant in a Virginia regiment. He was wounded in the shoulder at the battle of Trenton. In later campaigns he rose to the rank of major and saw action at the Brandywine, Germantown, and Monmouth engagements. Washington spoke of him as a brave officer, but Monroe failed to secure a permanent commission in his own state's military forces.

In 1780 Monroe left the army and began studying law under Thomas Jefferson, then governor of Virginia. For three years the young ex-officer followed a course of legal readings as directed by the older statesman, and the two spent much time together discussing law and its applications. Their friendship lasted until Jefferson's death in 1826. In writing to Jefferson, Monroe said, "I feel that whatever I am at present in the opinion of others, or whatever I may be in the future, has greatly arisen from your friendship."

Monroe married Elizabeth Kortright in 1786. She was the beautiful and socially prominent daughter of an English army officer who had remained in the United States after the Revolutionary War. The Monroes had two daughters, Eliza and Maria. (For an account of Elizabeth Monroe, *see* White House.)

Monroe was in turn a member of the Virginia assembly, of the United States Congress under the Articles of Confederation, of the state convention which ratified the Federal Constitution, and of the United States Senate under that Constitution. He was successively minister to France, Spain, and England, governor of Virginia for several terms, secretary of state and of war under President Madison, and finally was the fourth Virginian out of the first five presidents to hold the highest office in the American republic.

In the Virginia convention of 1788 Monroe, along with Patrick Henry and Richard Henry Lee, opposed the ratification of the Federal Constitution. He feared lest the United States might become a monarchy and he fought the Constitution until amendments were promised which he thought necessary to safeguard the rights of the people. In the United States Senate, when appointed as one of Virginia's first representatives in that body, he allied himself with Jefferson's party in favor of "strict construction," and opposed Hamilton's measures which were intended to strengthen the national government.


JAMES MONROE

Nevertheless, as his party was friendly to France, Washington sent Monroe as minister to that country in 1794, where he arrived a short time after the fall of Robespierre. Even the excesses of the Reign of Terror did not cool Monroe's ardor for the Revolution. Unfortunately he allowed his partisan feelings to carry him so far as to say in a public address in Paris that the treaty which John Jay, under Washington's direction, had just concluded between the United States and England was "the most shameful transaction I have ever known of the kind." For this and other indiscretions he was recalled in disgrace. When he returned to America he published a justification of his conduct in a pamphlet entitled 'A View of the Conduct of the Executive in the Foreign Affairs of the United States', in which he severely criticized Washington. Though the president took no notice of the pamphlet at the time, it is said that he never forgave Monroe for this unwarranted attack upon him and his actions.

In 1803 Monroe went to France a second time, sent by Jefferson as a special minister to aid in the negotiations which led to the purchase of Louisiana. After that memorable purchase was completed he went to Spain to try to buy the Floridas also, but in this negotiation he was unsuccessful. As minister to Great Britain he negotiated a treaty in 1806, but this was rejected by President Jefferson, who refused to lay it before the Senate because it contained no provisions against impressment and interference with the rights of neutral ships.

During the War of 1812 Monroe served under President Madison as secretary of state, and also for a time as secretary of war. The city of Washington was burned by the British during the time that Monroe acted as secretary of war but his measures as a whole won him popularity, and his position as secretary of state put him in line for the presidency.

In 1816 Monroe reached the pinnacle of his career when he was elected to succeed Madison as president, with Daniel D. Tompkins of New York as vice-president. Monroe's vote in the electoral college was 183, to 34 cast for Rufus King, the Federalist candidate. Monroe and Tompkins were re-elected almost unanimously in 1820; the one vote cast against him at that time is said to have been "so that no one might share with Washington the honor of a unanimous election."

MONROE'S ADMINISTRATIONS
1817–1825

"Era of good feeling" (1817–25)
Admission of Mississippi (1817), Illinois (1818), Alabama (1819), Maine (1820), and Missouri (1821).
Seminole Indian war in Florida (1817).
Joint occupation of Oregon country with Great Britain agreed upon (1818).
Florida purchased from Spain (1819).
Financial crisis (1819).
First steamship crosses the Atlantic (1819).
Monroe reëlected (1820).
Missouri compromise over slavery (1820).
Cumberland Road bill vetoed (1822).
Monroe doctrine set forth (1823).
Protective tariff bill passed (1824).
Internal improvements bill passed (1824).
Lafayette re-visits America (1824–25).
John Quincy Adams chosen president by House of Representatives (1824).

During Monroe's administrations he still displayed his interest in expanding the territory of the United States. He was successful in purchasing the Floridas from Spain in 1819, and by the successful prosecution of a war against the Seminole Indians he opened up that new region to settlement.

But expansion brought new and troublesome questions with it. If the people occupied an extensive territory, better means of communication were nec-

essary. Monroe was interested in seeing these secured, but as a strict constructionist he believed that Congress did not have the power to provide them. Consequently he vetoed a bill providing for internal improvements. A more important question in regard to the new territory was whether slavery should be allowed in it. The problem was temporarily settled in 1820 by the Missouri Compromise, but it was not finally decided until slavery was abolished at the close of the Civil War. (*See* Missouri Compromise.)

The period from 1817 to 1825, during which Monroe was president, has sometimes been called the "Era of Good Feeling," because there was only a single organized political party during that interval. There were, however, so many personal factions, each of which desired to see its leader president, that the election in 1824 has been called the "scrub race for president." The "Era" was also marked by the second visit of Lafayette to the United States.

With the inauguration of John Quincy Adams in 1825, Monroe retired to private life after a public career covering more than 40 years. During that time he had displayed no wonderful ability as legislator, diplomat, or executive; but he had proved an honest and patriotic citizen, whose motives were never questioned even by his enemies. Jefferson well said of him that "he is a man whose soul might be turned wrong side outwards without discovering a blemish to the world." His closing years were harassed by debt, and he removed from Virginia to find a home with his son-in-law, in New York City, where he died on July 4, 1831.

MONROE DOCTRINE. The "Monroe Doctrine" is the American belief that the United States cannot afford to let European nations extend their national territory in the Western Hemisphere, or interfere in western affairs with armed force. This famous doctrine has been a cornerstone of American foreign policy for more than a century. Many diplomatic notes have insisted upon it, and the United States has stood ready to fight for it on occasion. But it never received formal adoption until 1941. Then Congress placed it in the nation's laws by a joint resolution.

Monroe's Famous Message

The basis of the Doctrine is found in two declarations of President Monroe's message to Congress, Dec. 2, 1823, which were aimed at two troubling foreign situations.

Russia at that time planned to establish a colony on the Pacific coast, and in 1821 had forbidden foreign vessels to approach the northwest coast. There were also suggestions that the "Holy Alliance" of European powers which had just put down revolutions in Italy and Spain should interfere forcibly in Latin America to reëstablish Spanish rule over her colonies which had declared their independence.

This last proposal was opposed not only by the United States but also by Great Britain. The British foreign minister wished the United States and England to make a joint protest, but John Quincy Adams, then secretary of state, thought it better that the United States should make an independent declaration. With the advice of President Monroe, he formulated most of the contents of the Monroe Doctrine.

The first declaration was a warning to Russia that the American continents "are henceforth not to be considered as subjects for future colonization by any European powers." The second warned the allied powers of Europe (France, Prussia, Russia, and Austria) that "any attempt on their part to extend their system to any portion of this hemisphere" would be considered "as dangerous to our peace and safety." It was further stated that we could not view "in any other light than as the manifestation of an unfriendly disposition toward the United States" any attempt to oppress or control the destiny of governments whose independence we had recognized.

The Doctrine Proves Effective

The declaration had the desired result. Although it was necessary to call attention to the principles embodied in the Doctrine several times, no serious European interference on this continent was attempted until 1861 when Napoleon III tried to place Maximilian, an Austrian prince, upon the throne of Mexico. The United States was just entering upon the Civil War, but she made an immediate protest to France. As soon as peace was restored in 1865, she sent troops to the Rio Grande frontier, insisting upon the removal of the French army. Another notable application of the Doctrine was in the boundary dispute between British Guiana and Venezuela, 1895, when the United States succeeded in bringing about a settlement by arbitration.

In 1902, during Theodore Roosevelt's administration, a revolutionary government in Venezuela disregarded its obligations to investors in England, Germany, and Italy. When diplomacy failed, these nations threatened forcible redress, but the United States induced them to arbitrate. In his message to Congress in 1904, President Roosevelt maintained that in "flagrant cases of wrongdoing" by Latin American republics, the United States had the right to exercise an "international police power" over them. The policy of the "Big Stick," as it was called, caused the United States frequently to intervene in Latin American affairs. This extension of the Monroe Doctrine was resented by Latin Americans as an infringement of their sovereignty.

Successive administrations widened the scope of Monroe's original declarations. The warning addressed to Europe alone became applicable to all non-American powers, and the restriction of further colonization became an objection to the transfer of any territory in the New World. The Doctrine in this form has been invoked on several occasions, with overwhelming popular support in the United States.

The general tendency of American statesmanship in recent years has been to convert the Monroe Doctrine from a guarantee by the United States to a statement

of principle on the part of all the Pan American republics (the United States and Latin America). In 1933, under President F. D. Roosevelt's "good neighbor policy," the Pan American nations entered into an agreement that "no state has the right to intervene in the internal or external affairs of another." At the Havana meeting of foreign ministers in 1940, the 21 republics agreed jointly to guard the American hemisphere from aggression by foreign states. The Act of Chapultepec, adopted in the Mexico City conference of 1945, provided for the united defense, during the period of the second World War, of any American nation which might be threatened by an aggressor state either within or without the hemisphere (*see* Latin America).

When President Monroe proclaimed his famous doctrine, he informed European governments that the United States in turn would not interfere in the affairs of Europe. But as the United States rose to the position of a world power it began to take an interest in the affairs of both Europe and Asia. In 1947 President Truman launched a new world-wide doctrine when he proclaimed his plan to aid Greece and Turkey to prevent the spread of communistic imperialism (*see* Truman; United States History).

MONTAIGNE (*mon-tān'*), MICHEL EYQUEM DE (1533–1592). The famous French essayist Montaigne may be said to be "all things to all men." He has been read by people of many nations and of all sorts of beliefs since his first volumes appeared, nearly 400 years ago. Therefore we may be sure he did not take sides heatedly about most matters. His essays are whimsical, full of amusing twists. His style flows along as clearly and naturally as water.

Montaigne wrote of his own clumsiness, of how he could not harness a horse or carve a roast or fold a letter, and what a task he found it to tell lettuce from cabbage in his garden. Those are things about which all the world may smile, but not argue. Many a time he states ideas much more complicated and serious than his troubles with harnesses or cabbages, but always with suavity, openness to another's ideas, musing gentleness—sometimes even with a sly and cynical smile. But he attracts all men to fish for themselves, in silence, from the lovely waters of his great stream of essays, and nobody wrangles about Montaigne, any more than they would shout beside a trout stream.

Montaigne's training and life were extraordinary, and we perceive him, always dressed in plain black, as a lonely, rather bitter, eccentric, and even crotchety figure. Yet he could mourn half his life for his one great friend, Étienne de la Boëtie; and in his eye occasionally flamed a light such as that which shamed and drove away a scoundrel and crowd of ruffians who had marched into his house to plunder it.

When Montaigne was a baby he was nursed by a poor woman in a village, as his father wanted him to feel sympathy for the poor. And we ourselves may still feel sympathy for the poor of this same village, who were all obliged to learn Latin that they might always speak that tongue to the little Montaigne, and thus make it easy for the child to learn a language which was considered the foundation of education! The boy was also awakened always to the sound of music. Is it strange that he grew up to be a highly trained, refined, and singular man?

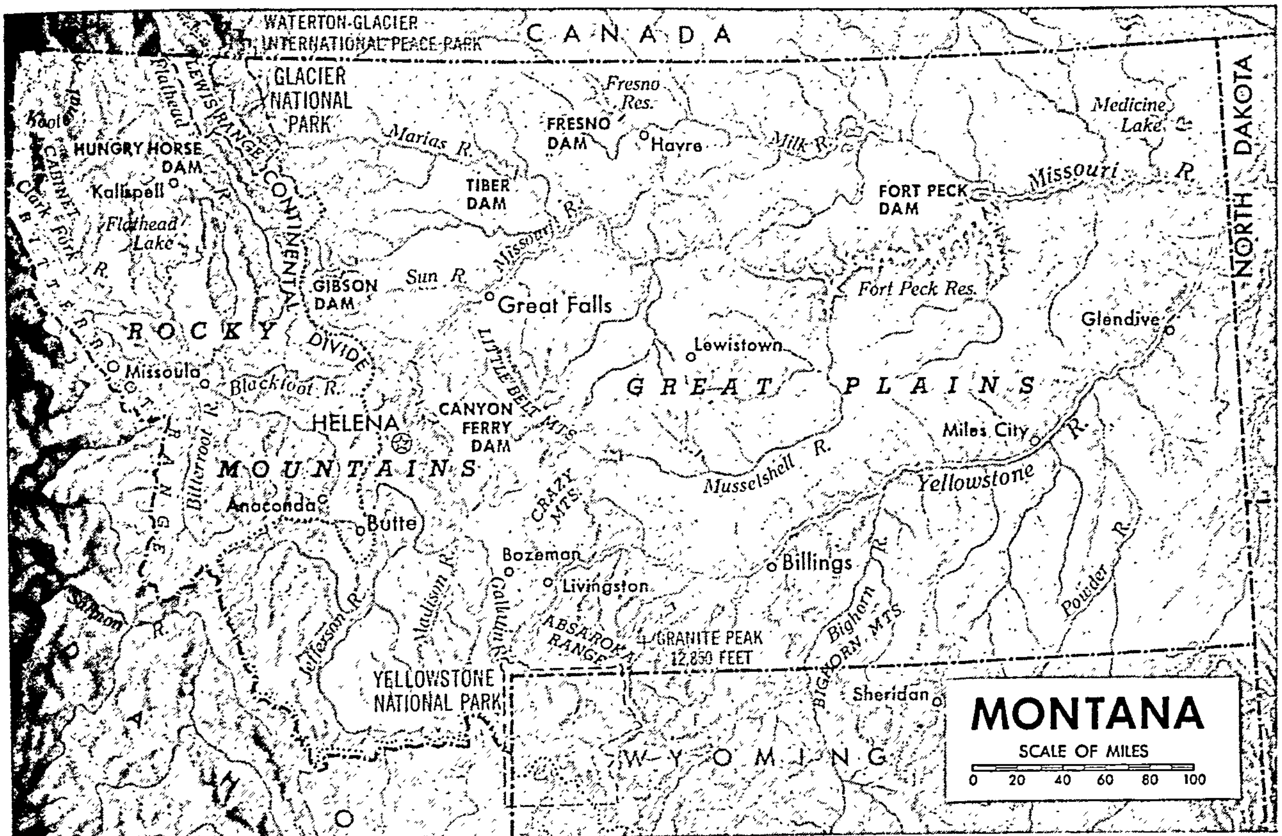
He loved solitude and had a tower built on his house, where he worked, and where he even had a little chapel and heard mass all alone. Not even his wife was allowed in his tower. Indeed, Montaigne had no very high opinion of the intelligence of women. And a mocking Fate so arranged it that his six children were all girls, and it was a young woman admirer, Marie le Jars de Gournay, to whom he confided his last literary ideas, and who therefore became editor of his essays after his death, revising them in accordance with notations which he left. The first two books of his essays appeared in 1580 and the third in 1588.

MONTANA, STATE *of* TREASURE *and* OPPORTUNITY

MONTANA. The third largest state in the Union is Montana. It is exceeded only by Texas and California. In area it is nearly three times as great as the state of New York. The mountains and forests in its western part would almost cover Ohio; the farm lands of its plains and valleys are almost equal in size to Minnesota; and Delaware and Maryland could be placed upon the vast grazing fields in the east. The beautiful Glacier Park in the northwest is larger than Rhode Island (*see* Glacier National Park).

The name "Montana" is a Latin word meaning "mountainous regions." It is a good description of the western third of the state where the Rocky Mountains stand in roughly parallel ranges—the Bitterroot, Absaroka, Beartooth, Kootenai, and others (*see* Rocky Mountains). Within these great mountains is the Continental Divide. Rivers rising east of this mountainous roof flow into the Atlantic Ocean or the Gulf of Mexico; those to the west flow into the Pacific. Montana's highest peaks rise east of the Divide and not along its crest. The state's highest point is Granite Peak, 12,850 feet, in the southwest. Narrow, fertile valleys lie between the ranges. Rivers, fed by numerous mountain streams, cut their way through these valleys. Here are the sources of the Clark Fork, part of the Columbia basin, and the Missouri. The Columbia and the Missouri are two of the greatest river systems in the nation. In the northwest, where the valleys widen, lies Flathead Lake.

The eastern two thirds of Montana belongs to the Great Plains region. From an elevation of 4,000 feet at the foothills of the Rockies, the land slopes eastward to an elevation of only 2,000 feet. This area of gently rolling plains is broken by a few isolated mountain groups which stand above the prairies like islands. Here are the deeply eroded courses



The nation's third largest state is divided into two regions. In the west are rugged ranges of the Rockies. Through them meanders the backbone of the continent, the Continental Divide. The eastern two thirds is a tableland broken by mountain groups.

cut by the Yellowstone and Missouri rivers and their tributaries. Irrigation projects and dry farming have made this an agricultural region. About 35 per cent of all the land is under federal control.

A State of Rich Mineral Deposits

It was not until after the United States had acquired Montana in 1803 as a part of the Louisiana Purchase that a reliable account of it was obtained. Lewis and Clark explored the country in 1805 and were among the first white men to set foot within its borders (*see* Lewis and Clark Expedition). For more than 50 years few people except trappers and Indian traders visited the territory. It remained a vast and almost unknown wilderness until the discovery of gold on tributaries of the Beaverhead River in 1862.

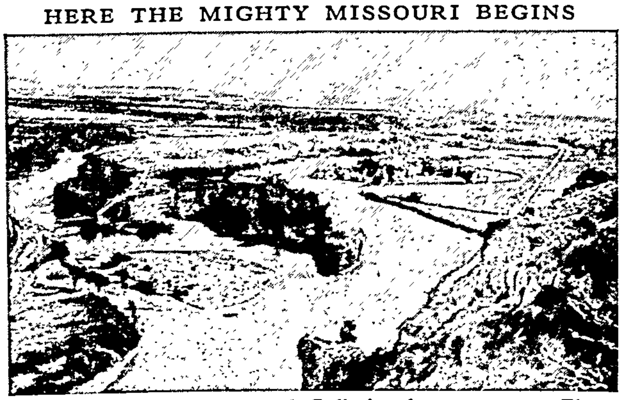
Thousands of eager prospectors then poured into the area. Towns grew up rapidly, and the first era of Montana's prosperity began. Helena sprang into being with the discovery of gold in Last Chance Gulch in 1864, and many other towns suddenly appeared where other rich deposits were found. Silver-lead ores were next developed. In a few years, however, gold and silver production began to decrease rapidly, and many old townsites were abandoned.

Then, not far from Butte, which had been a prosperous silver-mining town, a great discovery was made. In 1880, Marcus Daly, who had been mining silver there, sank a shaft in search of new silver ore. What he found was not silver but a thick, rich vein of copper. His discovery gave rise to one of the most important industries in Montana.

Copper ore was found at other places in the Butte district in seemingly inexhaustible quantities, and Butte became one of the greatest copper-mining centers in the world. Hundreds of miles of tunnels honeycomb the ground beneath it. Men work night and day in this subterranean city. At Anaconda are vast plants for smelting and refining copper. Some of the nation's richest resources of manganese are found near Butte and Philipsburg. Montana is a high-ranking zinc state, with the principal output from the Butte area.

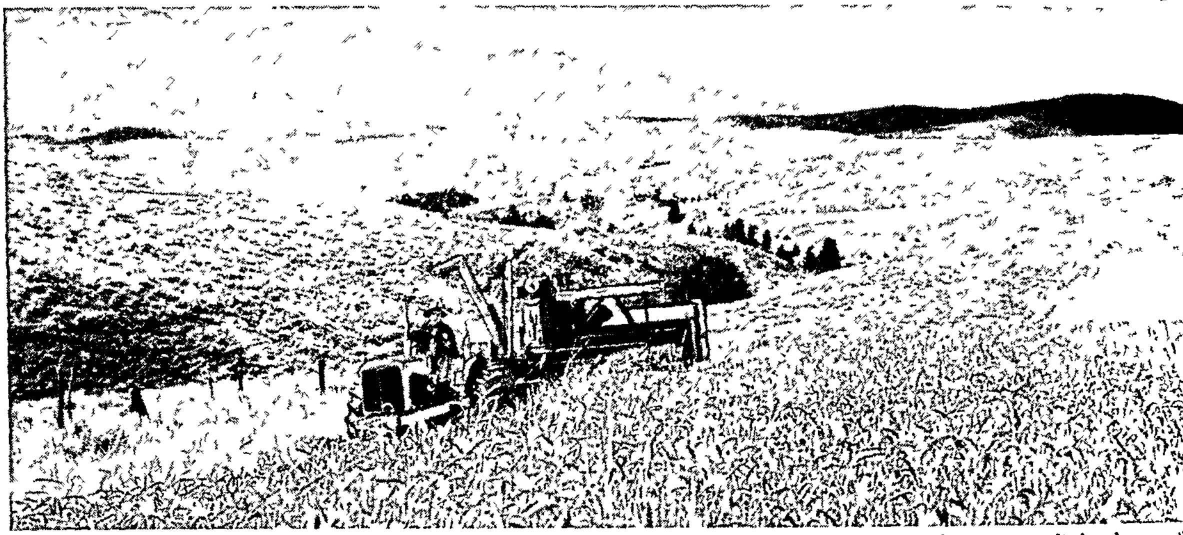
Petroleum is another valuable mineral. Almost all Montana's annual production of 8 or 9 million barrels of crude oil comes from Glacier, Toole, Pondera, Teton, and Carbon counties. The state has huge bituminous and lignite coal deposits, largely undeveloped.

HERE THE MIGHTY MISSOURI BEGINS



The Madison, Jefferson, and Gallatin rivers meet at Three Forks in southwestern Montana to form the Missouri River.

WAVY FIELDS OF WHEAT PRODUCE MONTANA'S TOP MONEY CROP



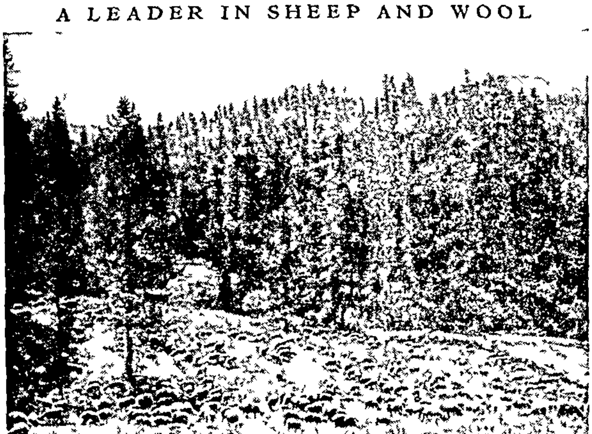
The farmer is harvesting wheat—long Montana's most important field crop in value. Most of the wheat acreage is of the hard spring variety. High in protein content, it is also greatly prized for its hardness, weight, and excellent milling quality.

Through the years Montana has mined more silver than any other state. Today it usually ranks third after Idaho and Utah in silver output. Lead and sand and gravel are also leading mined products. In all, about 60 different minerals have been found in the state.

Great Changes in Transportation

Trappers and fur traders used canoes, small river boats, and horses as their chief means of transportation. Not until 1859 did the first steamboats work their way up the shallow waters of the upper Missouri River as far as Fort Benton. From that point, wagons and pack trains carried supplies to the isolated trading posts and scattered settlements. Then the building of railroads made a great change in Montana's history. By 1880 the Utah and Northern Railroad had been extended from Ogden, Utah, through Idaho Falls, Idaho, northward to Dillon. In the following year the line was completed to Silver Bow. The products of Montana's mines could now be shipped to market easily and quickly. Cities like Fort Benton and the slow-moving river steamers lost their importance.

A LEADER IN SHEEP AND WOOL



These sheep are going to a summer range in Gallatin National Forest near Bozeman. Montana ranks high in sheep and wool.

Meanwhile, a transcontinental railroad, the Northern Pacific, was being built across the territory from both the east and the west. The line from the east reached Miles City in 1881 and soon extended up the valley of the Yellowstone River. The western section followed the valley of Clark Fork. In September 1883 the two lines were joined near Garrison. Later, other railroads as well as thousands of miles of highways and improved rural roads were constructed across the state's vast area.

Products of Farm, Ranch, and Orchard

Great herds of buffalo fattening on the rich wild grasses of the plains pointed out to the early settlers a more certain source of wealth than mining. Cattle raising soon became a major industry. Stockman and cowboy shared with the miner the task of building the state. Sheep raising increased until today Montana is one of the three leading sheep- and wool-producing states in the nation.

After 1900, homesteaders poured into the state, and farming soon became more important than mining. Today the yearly value of the wheat crop alone is usually greater than the total annual mineral production. Montana ranks among the top four states in the production of sugar beets. Hay, barley, and oats are other important products. The temperate valleys west of the Continental Divide also grow cherries, apples, berries, and other fruits. Because Montana has no large markets close by, produce and livestock are shipped long distances for marketing.

Much of the farming in Montana is done on a large scale. About one third of its farms are of 1,000 acres or larger. Because of the scarcity of rainfall most crops are grown by dry-farming methods or with the aid of irrigation. Some 2 million acres, or about one fifth of the total cropland, are under irrigation. Much of the water is supplied by the large rivers of the state—Flathead, Clark Fork, and Bitterroot in the west; and the Missouri, Milk and Yellowstone

Continued on page 377

Montana Fact Summary

MONTANA (Mont.): The name, a Latin word meaning "mountainous regions," suggests the rugged land that constitutes a great part of the state.

Nickname: "Treasure State"— a tribute to the great natural wealth of minerals, grazing lands, and forests found in Montana.

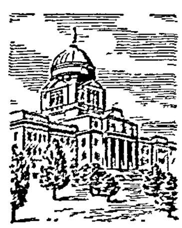
Seal: In the center is a plow and a miner's pick and shovel, below which is inscribed the state motto; on the right are the Great Falls of the Missouri River; on the left is a mountain scene.

Motto: Oro y Plata (Gold and Silver).

Flag: For description and illustration, *see* Flags.

Flower: Bitterroot. **Bird:** Western meadowlark. **Tree:** Ponderosa Pine. **Song:** 'Montana'—words by Charles C. Cohen; music by Joseph E. Howard.

THE GOVERNMENT



Capital: Helena (since 1875, when it became territorial capital).

Representation in Congress: Senate, 2; House of Representatives, 2. Electoral votes, 4.

Legislative Assembly: Senators, 56; term, 4 years. Representatives, 94; term, 2 years. Convenes first Mon. in Jan. in odd-numbered years. Session limit, 60 days.

Constitution: Adopted 1889. Proposed amendment must be (a) passed by a two-thirds majority in each house of the legislature and (b) ratified by a majority voting on amendment at a popular election.

Governor: Term, 4 years. May succeed himself.

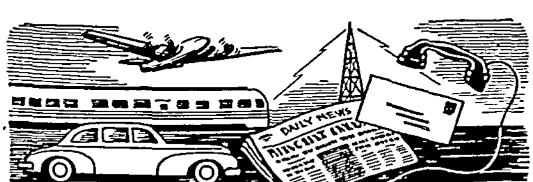
Other Executive Officers: Lieutenant governor, secretary of state, attorney general, treasurer, auditor, superintendent of public instruction, clerk of supreme court, all elected, term, 4 years; railroad commissioner elected for 6-year term.

Judiciary: Supreme court—5 justices, elected at large; term, 6 years. District courts—18; judges elected; term, 4 years.

County: 56 counties, each governed by a board of commissioners, usually 3 members; boards elected; term 6 years; officers elected; term, 4 years., except attorney, term, 2 years.

Municipal: Mayor-council plan most common; some cities and towns have commissioners, directors, or trustees.

Voting Qualifications: Age, 21; residence in state, 1 year; in county or precinct, 30 days.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 5,100 miles. First railroad, Ogden (Utah) to Dillon, 1880. Rural roads, 69,700 miles. Airports, 118.

Communication: Periodicals, 19. Newspapers, 107. First newspaper, the *Montana Post*, Virginia City, 1864. Radio stations (AM), 25; first station, KFBB, Great Falls, licensed July 11, 1922. Television stations, none. Telephones, 172,300. Post offices, 531.

THE PEOPLE AND THEIR LAND

Population (1950 census): 591,024 (rank among 48 states—42d); urban, 43.7%; rural, 56.3%. Density: 4.1 persons per square mile (rank—46th state).

Extent: Area, 147,138 square miles, including 1,260 square miles of water surface (3d state in size).

Elevation: Highest, Granite Peak, 12,850 feet, near Cooke; lowest, Kootenai River near Troy, 1,800 feet.

Temperature (°F.): Average—annual, 43°; winter, 21°; spring, 42°; summer, 64°; fall, 44°. Lowest recorded, —70° (Rogers Pass, Jan. 20, 1954); highest recorded, 117° (Medicine Lake, July 5, 1937, and other locations and earlier dates).

Precipitation: Average (inches)—annual, 15; winter, 2; spring, 4; summer, 6; fall, 3. Varies from about 10 in extreme south central and southwest to about 45 along central western border.

Natural Features: Rocky Mts. cross western section from northwest to southeast, creating 2 main areas. Western region is mountainous; narrow valleys lie between ranges; Flathead Lake. Great Plains in east are high rolling lands with wide valleys and isolated mountains. Chief rivers: Bitterroot, Clark Fork, Flathead, Milk, Missouri, Musselshell, Yellowstone.

Land Use: Cropland, 14%; nonforested pasture, 58%; forest, 23%; other (roads, parks, game refuges, wasteland, cities, etc.), 5%.

Natural Resources: *Agricultural*—loam soil of central, eastern, northeastern regions suitable for wheat; grassy plains, mountain valleys excellent for cattle, sheep grazing. *Industrial*—many minerals; forests. *Commercial*—mountains, scenery, game attract tourists.

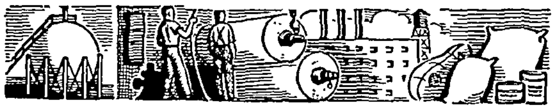
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Agriculture, forestry, and fishery.	54,989	25.0
Wholesale and retail trade....	41,628	19.1
Transportation, communication, and other public utilities......	22,509	10.3
Professional services (medical, legal, educational, etc.).........	19,232	8.8
Manufacturing................	18,515	8.5
Construction	14,771	6.8
Personal services (hotel, domestic, laundering, etc.)............	10,488	4.8
Government..................	10,107	4.6
Mining......................	9,342	4.3
Business and repair services.....	6,266	2.9
Finance, insurance, and real estate	5,018	2.3
Amusement, recreation, and related services...............	1,960	0.9
Workers not accounted for......	3,635	1.7
Total employed............	218,460	100.0

Montana Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—43d)
Value added by manufacture* (1952), $138,952,000

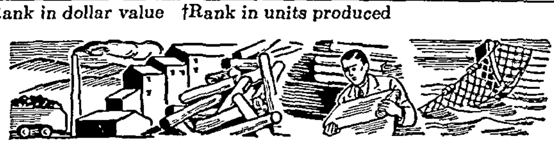
Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
FOOD AND KINDRED PRODUCTS..... Beet sugar; flour and meal; bakery products; meat packing	$26,230,000	39
LUMBER AND PRODUCTS...........	22,053,000	31
PETROLEUM AND COAL PRODUCTS..	7,855,000	25
PRINTING AND PUBLISHING........	6,062,000	40
PRIMARY METAL INDUSTRIES...... Copper, lead, and zinc smelting	........†	..

*For explanation of value added by manufacture, *see* Census.
†Figure withheld by the Bureau of the Census.

B. Farm Products (Rank among states—31st)
Total cash income (1952), $392,755,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Wheat...........	68,845,000 bu.	1	4
Cattle............	472,165,000 lbs.	2	14
Hay.............	2,612,000 tons	3	15
Sheep and lambs..	130,115,000 lbs.	4	3
Milk.............	317,000,000 qts.	5	36
Barley...........	14,692,000 bu.	6	7
Hogs............	77,542,000 lbs.	7	33
Wool............	24,879,000 lbs.	8	3
Sugar beets.......	816,000 tons	9	4
Oats.............	12,486,000 bu.	10	19

*Rank in dollar value †Rank in units produced



C. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $126,166,000
Rank among states—23d

Minerals (1951)*	Amount Produced	Value
Zinc................	86,000 tons	$31,141,000
Copper..............	57,000 tons	27,785,000
Petroleum...........	8,958,000 bbls.	22,130,000
Lead................	21,000 tons	7,370,000
Sand and gravel......	9,583,000 tons	6,202,000
Coal................	2,345,000 tons	6,162,000
Silver...............	6,394,000 ozs.	5,787,000

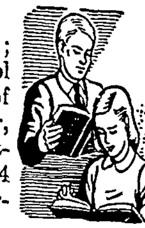
*Montana ranks 1st among the states in manganese ore production; exact figures not available.

D. Lumber (Rank among states—20th)
426,000,000 board feet (5-year average)

E. Trade

Trade (1948)	Sales	Rank among States
Wholesale.....	$604,244,000	39
Retail........	602,623,000	40
Service.......	46,276,000	41

EDUCATION



Public Schools: Elementary, 1,171; secondary, 176. Compulsory school age, 8 through 15. State Board of Education, 11 members: governor, state supt. of public instruction, attorney general (all ex officio; term, 4 yrs); 8 members appointed by governor (term, 8 yrs). County supts., elected; term, 4 yrs. School district boards of trustees, 3 to 7 elected members; term, 3 yrs. Boards of trustees appoint district supts.; term, up to 3 yrs.

Private and Parochial Schools: 81.

Colleges and Universities (accredited): Colleges, 8; junior colleges, 3. State-supported schools include Montana State University, Missoula; Montana State College, Bozeman; Montana School of Mines, Butte; 2 teachers colleges—Western Montana College of Education, Dillon; Eastern Montana College of Education, Billings; 1 junior college—Northern Montana, Havre.

Special State Schools: State Training School, Boulder; School for the Deaf and Blind, Great Falls; State Orphans Home, Twin Bridges.

Libraries: City and town public libraries, 27; independent county library systems, 25; 2 counties contract for service with city libraries. State Library Extension Comm. aids in developing library service. Noted special libraries: State Historical, Helena; U. S. Dept. of Interior, Bur. of Reclamation, Billings; U. S. Public Health Service, Rocky Mountain Laboratory, Hamilton.

Outstanding Museums: Museum of the Plains Indians, Browning; Historical Soc. Museum, Helena; Museum of Northwest History, Mont. State Univ., Missoula; Charles M. Russell Museum, Great Falls.

CORRECTIONAL AND PENAL INSTITUTIONS

State Industrial School, Miles City; State Vocational School for Girls, Helena; State Prison, Deer Lodge.

STATE FORESTS*†

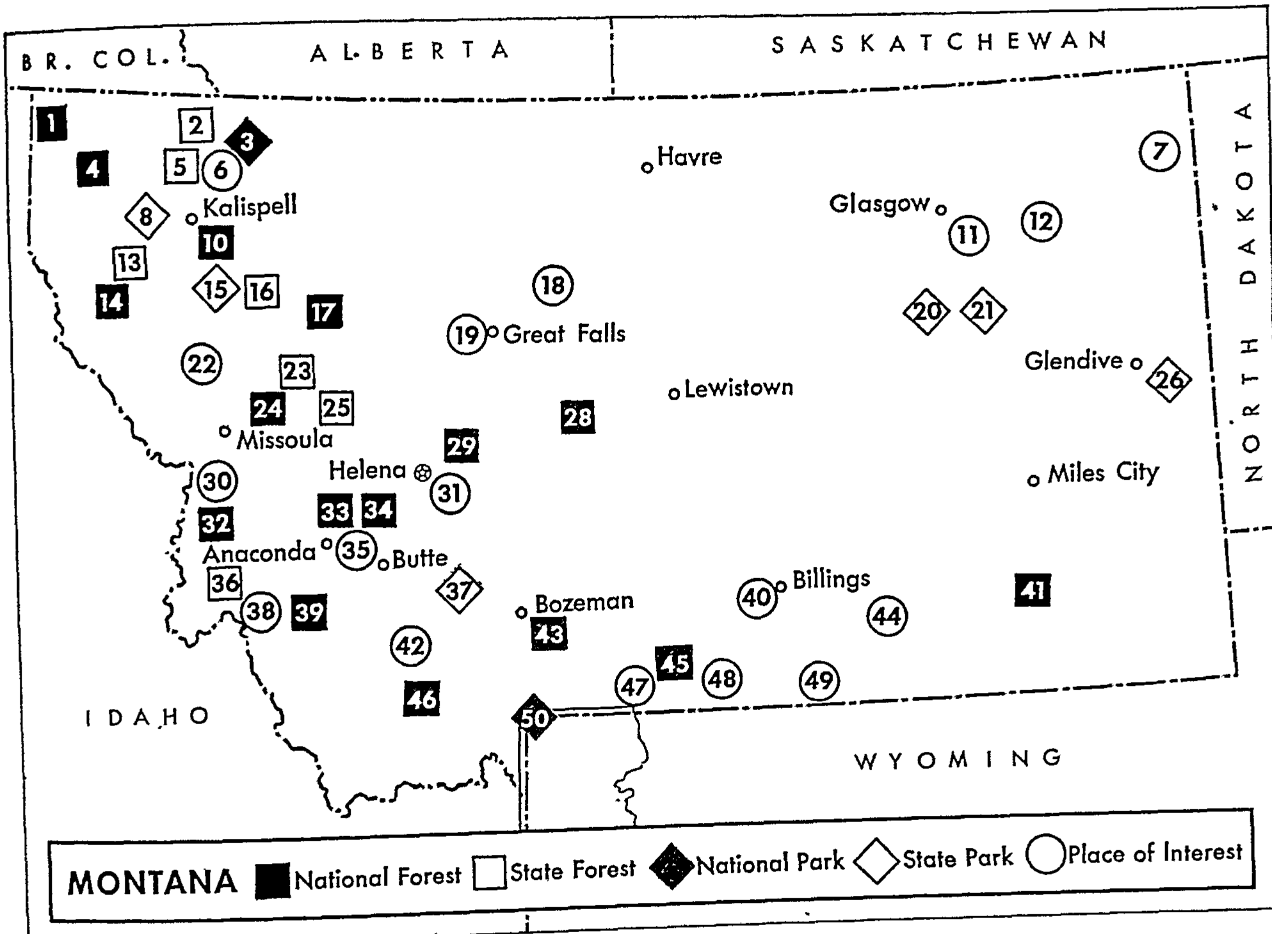
Clearwater (Missoula County)—18,000 acres (23).
Coal Creek (Flathead County)—20,000 acres (2).
Lincoln (Lewis and Clark County)—11,000 acres (25).
Stillwater (Flathead County)—90,000 acres (5).
Sula (Ravalli County)—14,000 acres (36).
Swan River (Lake County)—42,000 acres (16).
Thompson River (Sanders County)—30,000 acres (13).

NATIONAL FORESTS*

Beaverhead—2,216,364 acres; hdqrs., Dillon (39, 46).
Bitterroot—1,175,246 acres in state; total, 2,005,351 acres in Montana, Idaho; hdqrs., Hamilton (32).
Cabinet—1,361,209 acres; hdqrs., Thompson Falls (14).
Custer—1,196,569 acres in state; total, 1,274,395 acres in Montana, South Dakota; hdqrs., Billings (41, 45).
Deerlodge—1,329,841 acres; hdqrs., Butte (33).
Flathead—2,623,035 acres; hdqrs., Kalispell (10).
Gallatin—2,129,750 acres; hdqrs., Bozeman (43).
Helena—1,156,394 acres; hdqrs., Helena (29, 34).
Kaniksu—12,699 acres in state; total, 1,639,050 acres in Mont., Idaho, Wash.; hdqrs., Sandpoint, Idaho (1).
Kootenai—2,053,805 acres in state; total, 2,102,656 acres in Montana, Idaho; hdqrs., Libby (4).
Lewis and Clark—2,031,599 acres; hdqrs., Great Falls (17, 28).
Lolo—1,726,290 acres in state; total, 2,235,568 acres in Montana, Idaho; hdqrs., Missoula (24).

*Numbers in parentheses are keyed to map.
†An additional 318,000 acres are scattered state forest holdings.

Montana Fact Summary



STATE PARKS*

Flathead Lake—on west shore; fishing, boating (15).
Hell Creek—on Fort Peck Reservoir; recreation (20).
Lewis and Clark Cavern—near Butte; first discovered in 1902; tours through huge limestone cavern (37).
Little Bitterroot Lake—near Kalispell; area used primarily as youth camp (8).
Maco Sica (Bad Lands)—south of Glendive; picturesque formations, fossil remains, wildlife (26).
Rock Creek—on Fort Peck Res.; fishing, boating (21).
West Shore—on Flathead Lake; fishing, boating (15).
Yellow Bay—on east shore of Flathead Lake; beach (15).

NATIONAL PARKS*

Glacier—999,015 acres; outstanding scenic area; 60 glaciers and 250 lakes; "Going-to-the-Sun Highway" crosses Continental Divide through Logan Pass (alt. 6,654 ft.); with Waterton Lakes National Park, Canada, forms Waterton-Glacier International Peace Park (3).
Yellowstone—142,502 acres in Mont. of total of 2,213,207 acres; rest in Wyo. and Idaho; entrances in Mont. at Gardiner, W. Yellowstone, and Silver Gate (50).

PLACES OF INTEREST*

Bannack State Monument—1st territorial capital of Montana; west of Dillon; ghost town; southwest of (42).
Big Hole Battlefield National Monument—in Beaverhead National Forest, near Sula; site of battle between U.S. troops and Nez Percé Indians in 1877 (38).
Bighorn Canyon—near Hardin; 50-mile-long canyon with cliffs rising almost 3,000 feet (49).
Charles M. Russell Memorial Museum—Great Falls; studio of cowboy artist; contains art work, relics (19).
Custer Battlefield National Monument—near Crow Agency; site of battle of the Little Bighorn, 1876 (44).
Fort Benton—settled in 1846; old trading post (18).
Fort Peck Dam—near Fort Peck; largest earth-filled dam in world, 250 feet high, 21,026 feet long (11).
Giant Springs—Great Falls; discovered by Lewis and Clark, 1805; 388 million gals. flow each day (19).
Grasshopper Glacier—near Cooke; millions of frozen grasshoppers in 80-ft. ice cliff; nearby is Granite Peak (12,850 ft.), state's highest point (47).
Helena—State Capitol; St. Helena Roman Catholic Cathedral (*see* Helena) (31).
Hungry Horse Dam—on South Fork of Flathead R.; 3d highest in U. S.; 564 ft. high, 2,115 ft. long (6).
Kerr (Polson) Dam—on Flathead River; at (15).
Medicine Lake National Wildlife Refuge—nesting place for many species of migratory waterfowl (7).
Missouri River Headwaters State Monument—near Three Forks where 3 rivers form Missouri R.; e. of (37).
National Bison Range—Ravalli; buffalo, elk, deer (22).
Range Rider of Yellowstone—statue on Black Otter Trail, Billings; posed by Bill Hart and horse (40).
Red Lodge-Cooke Highway—scenic mountain route to Yellowstone National Park (48).
Robbers' Roost—Sheridan; stage station of 1860's; was favorite meeting place of bandits and outlaws (42).
St. Mary's Mission—Stevensville; log church (1867) (30).
Virginia City—second territorial capital (1865–75); gold rush boom town; restored buildings; museum (42).
Washoe Smelter—Anaconda; world's largest smokestack (585 ft.) at great copper smelter (35).
Wolf Point—on Ft. Peck Reservation, home of Assiniboine Indians; features "Stampede" summer rodeo (12).

*Numbers in parentheses are keyed to map.

Montana Fact Summary

LARGEST CITIES (1950 census)

Great Falls (39,214): hydroelectric power; copper and zinc refining; railroad shops; flour mills; meat packing.

Butte (33,251): copper-mining center; also processes zinc, manganese, and other metals; stockyards, meat packing.

Billings (31,834): livestock market; sugar-beet factories; oil refineries; railroad shops.

Missoula (22,485): lumbering and dairy center; railroad shops; beet sugar; Montana State University.

Helena (17,581): state capital; in mining and stock-raising area; railroad shops; copper smelting.

Bozeman (11,325): Montana State College; food processing; forest products.

Anaconda (11,254): in center of rich mineral deposits; huge copper smelter; winter sports resort.

Kalispell (9,737): agricultural, lumbering, dairying center.

THE PEOPLE BUILD THEIR STATE

1738—Pierre Gaultier de Varennes, Sieur de la Vérendrye, obtains fur-trading grant in region from France.

1742—Vérendrye's sons, Pierre and François, cross Dakota plains; may have sighted Bighorn Mountains of present Montana.

1762—France cedes area including Montana east of Rocky Mountains to Spain; Spain secretly returns land, 1800.

1803—By Louisiana Purchase, Montana east of Rocky Mountains becomes U.S. territory; parts of region included in territories of Oregon, 1848; Washington, 1853; Nebraska, 1854; Dakota, 1861.

1804—Meriwether Lewis and William Clark begin exploration of Missouri Valley and west to Pacific; reach mouth of Yellowstone River, April 26, 1805; leave Montana area through Lolo Pass, September 11; return through Montana, 1806.

1805—François Larocque of the North West Company explores Yellowstone region.

1806—David Thompson, great geographer, crosses Rocky Mountains from Canada for North West Company; builds Kootenai House on Kootenai River, 1807; builds Salish House near Thompson Falls, 1809; explores Flathead region, 1810; returns to Canada after carefully mapping region, 1812.

1807—Manuel Lisa builds Fort Manuel, first American outpost in Montana area, at mouth of Bighorn River.

1809—St. Louis Missouri Fur Company organizes and sends fur traders to upper Missouri River.

1810—Pierre Ménard and Andrew Henry build trading post near Three Forks; driven out by Blackfeet Indians.

1819—Spain gives up claim to region west of Rocky Mountains north of 42d parallel; Russia cedes claim to same region south of 54° 40′ N., 1824.

1822—William H. Ashley and Andrew Henry organize Rocky Mountain Fur Company in St. Louis; Henry and party build Fort Henry at mouth of Yellowstone River; build post at mouth of Bighorn River, 1823.

1828—Kenneth MacKenzie builds Fort Union, American Fur Company post, at mouth of Yellowstone.

1832—Pierre Chouteau, Jr., brings first steamboat up Missouri River to Fort Union.

1835—Fort Van Buren, American Fur Company post, established near mouth of Tongue River.

1841—Pierre Jean De Smet, a Jesuit, founds first mission in area, St. Mary's, near present Stevensville.

1842—De Smet plants first crops in Montana at St Mary's Mission; builds first gristmill, 1845.

1844—American Fur Company post, Fort Lewis, built near mouth of Marias River; removed to Missouri R. in 1846; renamed Fort Benton in 1850.

1846—Oregon Treaty with Great Britain settles boundary dispute; western Montana south of 49th parallel definitely becomes part of U.S.

1851—Major John Owen builds Fort Owen on site of St. Mary's Mission.

1853—John Grant starts first beef herd in Montana in Deer Lodge Valley. Isaac I. Stevens surveys railway route across Montana.

1854—Mission St. Ignatius established south of Flathead Lake.

1857—First sheep ranching begins in Bitterroot Valley.

1858—Lieut. John Mullan starts first wagon road over northern Rocky Mountains from Fort Benton to Walla Walla, Wash.; road completed, 1862.

1859—*Chippewa* is first steamboat to reach Fort Benton.

1862—Gold discovered near Beaverhead River; town of Bannack springs up near strike.

1863—Rich gold deposits discovered in Alder Gulch near present Virginia City; schools started at Bannack and Nevada City. Idaho Territory organized; includes all Montana. John M. Bozeman builds wagon trail from Oregon Trail to Montana gold camps; Indians begin attacks on wagon trains, 1864.

1864—Montana Territory created, May 26; governor, Sidney Edgerton; legislature meets at Bannack. Gold discovered at Helena.

1865—Virginia City becomes territorial capital.

1866—Telegraph line built to Virginia City from Salt Lake City. Fort C. F. Smith, Montana's first army post, established on Bighorn River; Indians attack post, 1867; troops withdrawn, 1868; area is declared Indian reservation. First public school opens at Virginia City.

1875—Territorial capital moved to Helena. William Farlin finds rich silver veins near Butte.

1876—Col. George A. Custer and troops killed by Sioux in battle of the Little Bighorn, June 25.

1877—Defeat of Nez Percé Indians in Bear Paw Mountains ends major Indian troubles in Montana.

1878—Fort Custer established at junction of Bighorn and Little Bighorn rivers.

1880—Marcus Daly begins mining copper at Butte.

1884—Constitution drafted at convention in Helena.

1889—Montana admitted to the Union, November 8; capital, Helena; governor, Joseph K. Toole.

1890—Power plant and smelter built at Great Falls.

1893—Montana State University established by legislature; opens at Missoula, 1895.

1902—Washoe Smelter built at Anaconda.

1907—State adopts initiative and referendum. Huntley irrigation project in Yellowstone County completed.

1910—Glacier National Park created, May 11.

1912—Direct primary adopted.

1915—Oil discovered in Elk Horn Basin.

1916—Jeannette Rankin, born near Missoula, is first woman elected to U.S. Congress.

1938—Kerr (Polson) Dam on Flathead River completed.

1940—Fort Peck Dam on Missouri River completed.

1947—Mining of low-grade copper ore begins at Butte.

1952—Hungry Horse Dam on South Fork of Flathead River completed.

MONTANA

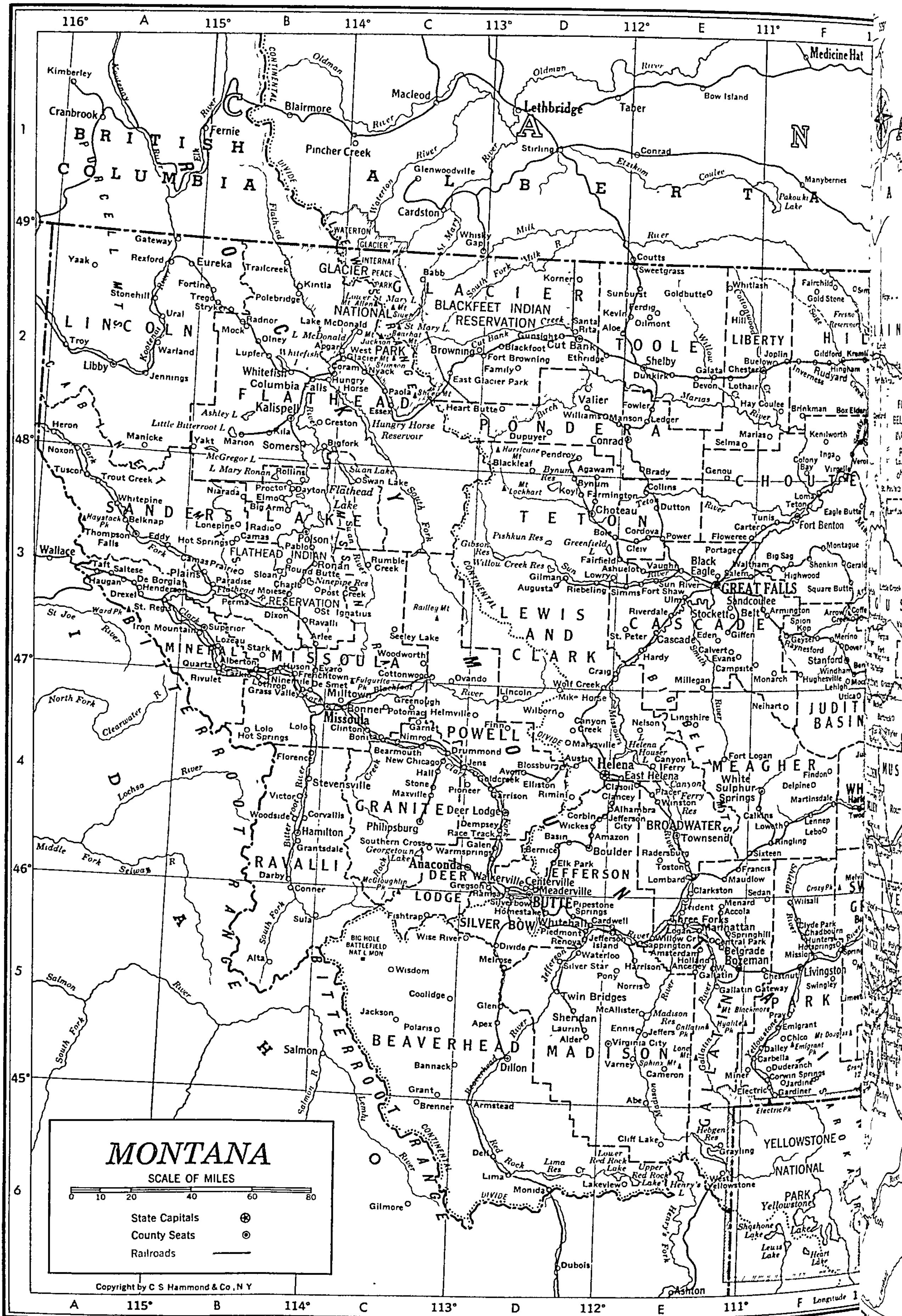
COUNTIES

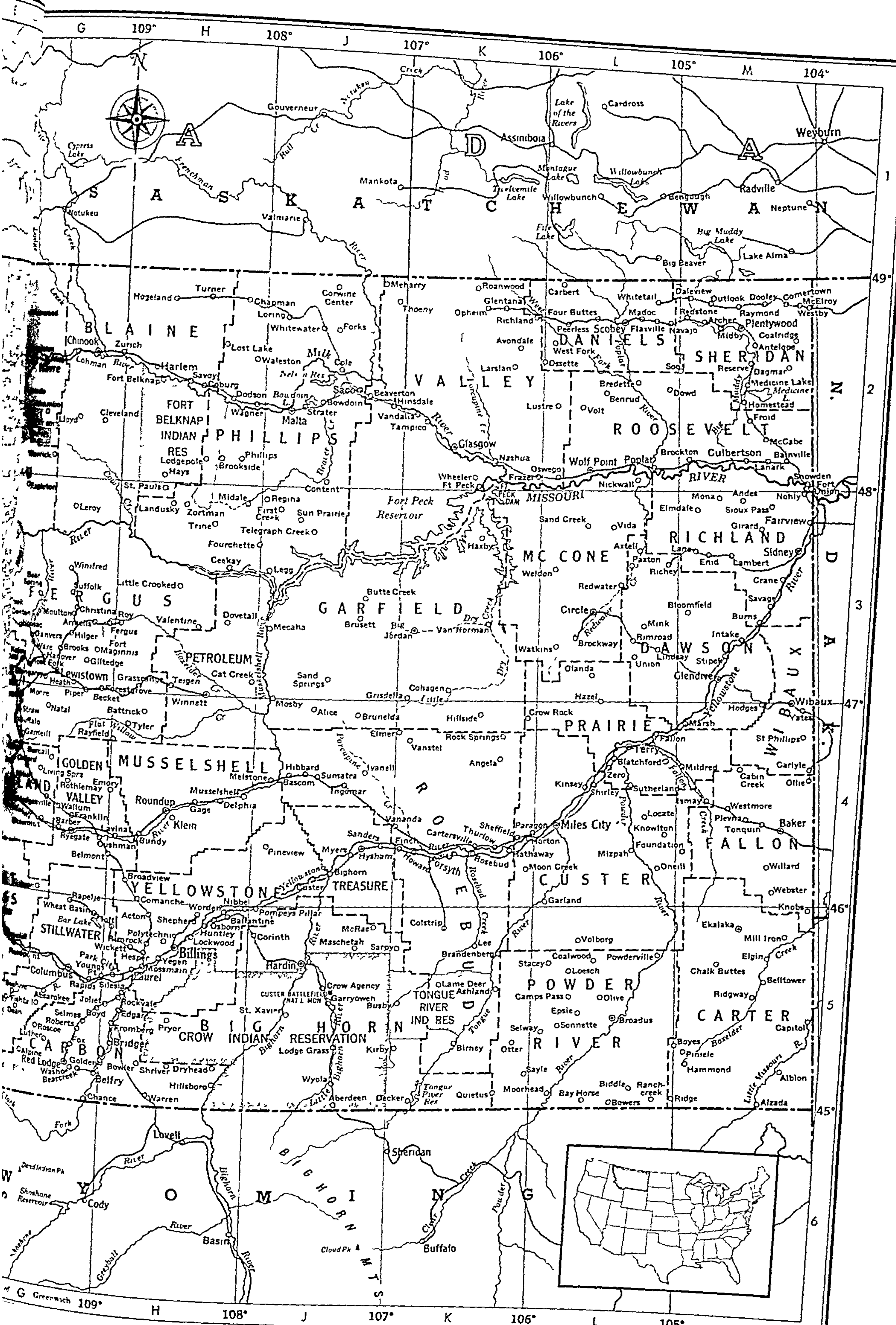
Beaverhead	6,671	C 5
Big Horn	9,824	J 5
Blaine	8,516	G 2
Broadwater	2,922	E 4
Carbon	10,241	G 5
Carter	2,798	M 5
Cascade	53,027	E 3
Chouteau	6,974	F 3
Custer	12,661	L 4
Daniels	3,946	L 2
Dawson	9,092	M 3
Deer Lodge	16,553	C 5
Fallon	3,660	M 4
Fergus	14,015	G 3
Flathead	31,495	B 2
Gallatin	21,902	E 5
Garfield	2,172	J 3
Glacier	9,645	C 2
Golden Valley	1,337	G 4
Granite	2,773	C 4
Hill	14,285	F 2
Jefferson	4,014	D 4
Judith Basin	3,200	F 4
Lake	13,835	B 3
Lewis and Clark	24,540	D 3
Liberty	2,180	E 2
Lincoln	8,693	A 2
Madison	5,998	D 5
McCone	3,258	L 3
Meagher	2,079	F 4
Mineral	2,081	B 3
Missoula	35,493	C 3
Musselshell	5,408	H 4
Park	11,999	F 5
Petroleum	1,026	H 3
Phillips	6,334	J 2
Pondera	6,392	D 2
Powder River	2,693	L 5
Powell	6,301	D 4
Prairie	2,377	L 4
Ravalli	13,101	B 4
Richland	10,366	M 3
Roosevelt	9,580	L 2
Rosebud	6,570	K 4
Sanders	6,983	A 3
Sheridan	6,674	M 2
Silver Bow	48,422	D 5
Stillwater	5,416	G 5
Sweet Grass	3,621	G 5
Teton	7,232	D 3
Toole	6,867	E 2
Treasure	1,402	J 4
Valley	11,353	K 2
Wheatland	3,187	G 4
Wibaux	1,907	M 4
Yellowstone	55,875	H 4
Yellowstone Nat'l Park*	58	F 6

CITIES AND TOWNS

Abe		E 5
Aberdeen	8	J 5
Absarokee	423	G 5
Accola		E 5
Acton	14	H 5
Agawam	17	D 2
Alberton	326	B 3
Albion	6	M 5
Alder	100	D 5
Alhambra	43	E 4
Alice		J 4
Aloe		D 2
Alpine		G 5
Alta	4	B 5
Alzada	75	M 5
Amazon	1	E 4
Amsterdam	65	E 5
Anaconda	11,254	C 4
Anceney	10	E 5
Andes	32	M 3
Angela	7	K 4
Antelope	125	M 2
Apex		D 5
Apgar	76	C 2
Archer	5	M 2
Arlee	300	B 3
Armells	3	G 3
Armington	120	F 3
Armstead	200	D 6
Arrow Creek	25	F 3
Ashland	150	K 5
Ashuelot		E 3
Augusta	475	D 3
Austin	50	D 4
Avon	200	D 4
Avondale	5	K 2
Axtell	50	L 3
Babb	25	C 2
Bainville	356	M 2
Baker	1,772	M 4
Ballantine	298	J 5
Bannack	130	C 5
Barber	60	G 4
Bascom		J 4
Basin	300	D 4
Battrick	3	H 4
Bay Horse	39	L 5
Bear Spring	50	G 3
Bearcreek	162	G 5
Bearmouth	15	C 4
Beaverton	20	J 2
Becket	3	G 4
Beehive	12	G 5
Belfry	200	H 5
Belgrade	663	E 5
Belknap	72	A 3
Belltower		M 5
Belmont	25	G 4
Belt	702	E 3
Benchland	57	F 3
Benrud	20	L 2
Bercail	2	G 4
Bernice	2	D 4
Biddle	5	L 5
Big Arm	100	B 3
Big Sag	6	F 3
Big Sandy	743	G 2
Big Timber	1,679	G 5
Bigfork	450	C 2
Bighorn	21	J 4
Billings	31,834	H 5
Birney	35	K 5
Black Eagle	1,449	E 3
Blackfoot	200	D 2
Blackleaf		D 2
Blatchford	8	L 4
Bloomfield	40	M 3
Blossburg	35	D 4
Bole		D 3
Bonita	150	C 4
Bonner	250	C 4
Boulder	1,017	E 4
Bowdoin		J 2
Bowers	26	L 5
Bowler	8	H 5
Box Elder	284	F 2
Boyd	32	G 5
Boyes	25	M 5
Bozeman	11,325	F 5
Brady	435	E 2
Brandenberg	49	K 5
Bredette	110	L 2
Brenner		C 6
Bridger	854	H 5
Brinkman	15	F 2
Broadus	517	L 5
Broadview	164	H 4
Brockton	350	M 2
Brockway	103	L 3
Brooks	11	G 3
Brookside	25	H 2
Browning	1,691	C 2
Brunelda	13	J 4
Brusett	20	J 3
Buelow		E 2
Buffalo	150	G 4
Bundy		H 4
Burnham	26	G 2
Burns	8	M 3
Busby	20	J 5
Butte	33,251	D 5
Butte Creek		J 3
Bynum	52	D 3
Cabin Creek	6	M 4
Calkins		F 4
Calvert		E 3
Camas	125	B 3
Camas Prairie	5	B 3
Cameron	138	E 5
Camps Pass		L 5
Campsite	3	E 3
Canton	10	E 4
Canyon Creek	76	D 4
Canyon Ferry	150	E 4
Capitol	4	M 5
Carbella	5	F 5
Carbert		L 2
Cardwell	98	E 5
Carlyle		M 4
Carter	100	E 3
Cartersville		K 4
Cascade	447	E 3
Cat Creek	65	H 3
Ceekay		H 3
Centerville	1,800	D 4
Central Park		E 5
Chadbourn	7	F 5
Chalk Buttes	41	M 5
Chance	7	H 5
Chapman	35	J 2
Charlo	260	B 3
Chester	733	E 2
Chestnut	12	F 5
Chico	20	F 5
Chinook	2,307	G 2
Choteau	1,618	D 3
Christina	20	G 3
Circle	856	L 3
Clancey	161	E 4
Clarkston	20	E 4
Clasoil	8	E 4
Cleiv		E 3
Cleveland	17	G 2
Cliff Lake	21	E 6
Clinton	150	C 4
Clyde Park	280	F 5
Coalridge	49	M 2
Coalwood	2	L 5
Coburg		H 2
Coffee Creek	50	F 3
Cohagen	36	K 3
Cole		J 2
Collins	26	E 3
Colony Bay		F 2
Colstrip	300	K 5
Columbia Falls	1,232	B 2
Columbus	1,097	G 5
Comanche	12	H 4
Comertown	50	M 2
Conner	150	B 5
Conrad	1,865	D 2
Content		J 3
Cooke	45	G 5
Coolidge	2	C 5
Coram	500	C 2
Corbin	50	D 4
Cordova	175	E 3
Corinth	16	J 5
Corvallis	350	C 4
Corwin Springs	2	F 5
Corwine Center		J 2
Cottonwood	40	G 2
Cottonwood		C 3
Craig	80	D 3
Crane	50	M 3
Creston	200	C 2
Crow Agency	500	J 5
Crow Rock		L 4
Culbertson	779	M 2
Cushman	17	H 4
Custer	300	J 4
Cut Bank	3,721	D 2
Dagmar	46	M 2
Dailey		F 5
Daleview		M 2
Danvers	32	G 3
Darby	415	B 4
Dayton	95	B 3
DeBorgia	75	A 3
De Smet	10	C 4
Dean	92	G 5
Decker	21	K 5
Deer Lodge	3,779	D 4
Dell	150	D 6
Delphia	14	H 4
Delpine		F 4
Dempsey	10	D 4
Denton	435	G 3
Devon	50	E 2
Dillon	3,268	D 5
Divide	116	D 5
Dixon	250	B 3
Dodson	330	H 2
Dooley	17	M 2
Dover	20	F 3
Dovetail	35	H 3
Dowd		M 2
Drexel	9	A 3
Drummond	531	D 4
Dryhead	4	H 5
Duderanch	3	F 5
Dunkirk	13	E 2
Dupuyer	125	D 2
Dutton	431	E 3
Eagle Butte	72	F 3
Eagleton		G 3
East Glacier Park	300	C 2
East Helena	1,216	E 4
Eddy	25	A 3
Eden	5	E 3
Edgar	160	H 5
Ekalaka	904	M 5
Electric	20	F 5
Elgin	15	M 5
Elk Park	80	D 4
Elliston		D 4
Elmdale	25	M 3
Elmer	10	J 4
Elmo	104	B 3
Emigrant	25	F 5
Emory		G 4
Enid	8	M 3
Ennis	600	E 5
Epsie	65	L 5
Essex	75	C 2
Ethridge	45	D 2
Eureka	929	B 2
Evans	50	E 3
Evaro	92	C 3
Fairchild	20	F 2
Fairfield	693	D 3
Fairview	942	M 3
Fallon	251	L 4
Family	150	D 2
Farmington	30	D 3
Ferdig	15	E 2
Fergus	4	H 3
Finch		K 4
Findon		F 4
Finn	50	D 4
First Creek		J 3
Fishtail	50	G 5
Fishtrap	10	C 5
Flaxville	220	L 2
Florence	350	B 4
Floweree	60	E 3
Forestgrove	25	H 3
Forks	3	J 2
Forsyth	1,906	K 4
Fort Belknap		H 2
Fort Benton	1,522	F 3
Ft. Browning	1,674	D 2
Fort Logan		E 4
Fort Maginnis	4	H 3
Fort Peck	1,214	K 2
Fort Shaw	180	E 3
Fort Union		M 2
Fortine	100	A 2
Foundation		L 4
Four Buttes	50	L 2
Fourchette		H 3
Fowler		E 2
Fox	15	G 5
Francis	10	F 4
Franklin	7	G 4
Frazer	575	K 2
Frenchtown	100	B 3
Fresno	10	G 2
Froid	555	M 2
Fromberg	442	H 5
Gage	8	H 4
Galata	63	E 2
Galen	220	D 4
Gallatin Gateway	200	E 5
Gardiner		F 5
Garland	3	L 4
Garneill	33	G 4
Garnet	20	C 4
Garrison	150	D 4
Garryowen	28	J 5
Gateway	50	A 2
Genou	25	E 2
Geraldine	374	F 3
Geyser	150	F 3
Gibson		G 4
Giffen	12	E 3
Gildford	340	F 2
Gilman	15	D 3
Giltedge	8	G 3
Girard	7	M 3
Glasgow	3,821	K 2
Glen	100	D 5
Glendive	5,254	M 3
Glengarry	7	G 3
Glentana	65	K 2
Gold Stone	9	F 2
Goldbutte		E 2
Goldcreek	190	D 4
Golden		G 5
Grant	25	C 5
Grantsdale	50	B 4
Grass Valley		B 4
Grassrange	234	H 3
Grayling	20	E 6
Great Falls	39,214	E 3
Greenough	50	C 4
Gregson	35	D 4
Greycliff	125	G 5
Grisdella	2	J 3
Gunsight		D 2
Hall	100	C 4
Hamilton	2,678	B 4
Hammond	10	M 5
Hanover	100	G 3
Hardin	2,306	J 5
Hardy		E 3
Harlem	1,107	H 2
Harlowton	1,733	F 4
Harrison	305	E 5
Hathaway	25	K 4
Haugan	70	A 3
Havre	8,086	G 2
Haxby	25	K 3
Hay Coulee	12	F 2
Hays	150	H 2
Hazel		L 3
Heart Butte	50	C 2
Heath	16	G 3
Hedgesville	25	G 4
HELENA	17,581	E 4
Helmville	150	C 4
Henderson		A 3
Heron	200	A 2
Hesper	27	H 5
Hibbard		J 4
Highwood	272	F 3
Hilger	42	G 3
Hill		E 2
Hillsboro	4	H 5
Hillside		K 4
Hingham	214	F 2
Hinsdale	350	K 2
Hobson	205	G 4
Hodges	40	M 4
Hogeland	75	H 2
Holland		E 5
Homestake	15	D 5
Homestead	87	M 2
Hoosac	4	G 3
Horton		L 4
Hot Springs	733	B 3
Howard		K 4
Hughesville	18	F 3
Hungry Horse		B 2

*Population for Montana part only. See Wyoming & Idaho.

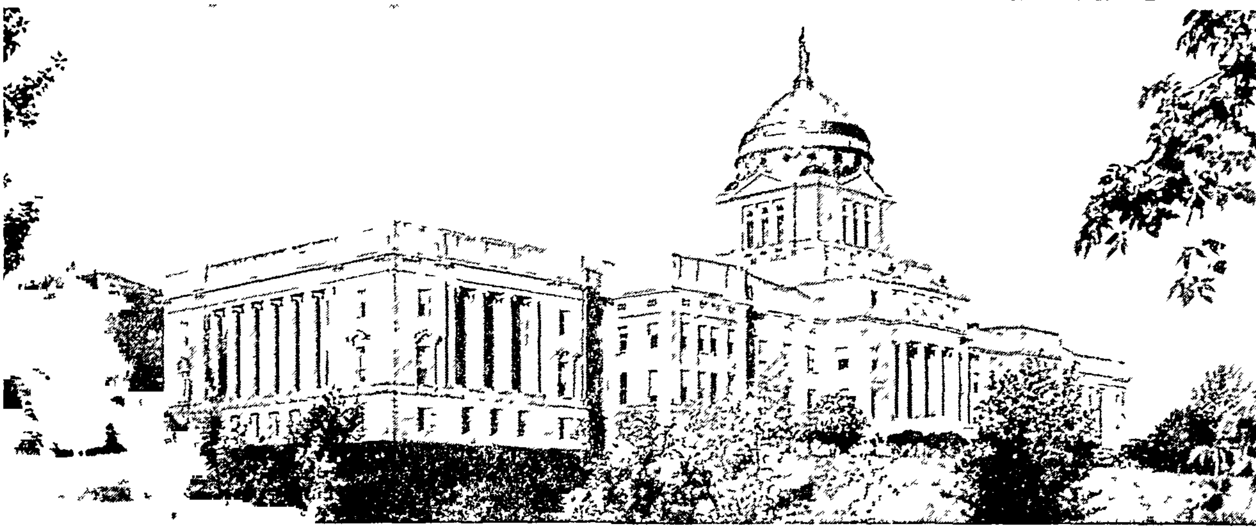

MONTANA
SCALE OF MILES
0 10 20 40 60 80
State Capitals
County Seats
Railroads
Copyright by C S Hammond & Co , N Y
BRITISH COLUMBIA
ALBERTA
CANADA
LINCOLN
FLATHEAD
GLACIER
TOOLE
LIBERTY
PONDERA
TETON
CHOUTEAU
SANDERS
LAKE
MINERAL
MISSOULA
POWELL
LEWIS AND CLARK
CASCADE
JUDITH BASIN
MEAGHER
BROADWATER
JEFFERSON
GRANITE
DEER LODGE
SILVER BOW
RAVALLI
BEAVERHEAD
MADISON
GALLATIN
PARK
GLACIER NATIONAL PARK
BLACKFEET INDIAN RESERVATION
FLATHEAD INDIAN RESERVATION
YELLOWSTONE NATIONAL PARK
BITTERROOT RANGE
CONTINENTAL DIVIDE
Helena
Great Falls
Butte
Missoula
Kalispell
Bozeman
Dillon
Anaconda
Livingston
Lethbridge
Medicine Hat
Cranbrook
Salmon
116° 115° 114° 113° 112° 111°
49° 48° 47° 46° 45°
Longitude



G
109°
H
108°
J
107°
K
106°
L
105°
M
104°
N
S A S K A T C H E W A N
Cypress Lake
Frenchman
Gouverneur
Mankota
Valmarie
Notukeu
Assiniboia
Lake of the Rivers
Cardross
Weyburn
Montague Lake
Twelvemile Lake
Willowbunch Lake
Willowbunch
Bengough
Radville
Neptune
Fife Lake
Big Muddy Lake
Lake Alma
Big Beaver
1
49°
Hogeland
Turner
Chapman
Corwine Center
Loring
Whitewater
Forks
Meharry
Thoeny
Roanwood
Glentana
Opheim
Richland
Carbert
Four Buttes
Whitetail
Daleview
Outlook
Dooley
Comertown
McElroy
Westby
Madoc
Redstone
Raymond
Archer
Plentywood
Peerless
Scobey
Flaxville
Navajo
Midby
Coalridge
Antelope
BLAINE
Chinook
Zurich
Lohman
Harlem
Fort Belknap
Savoy
Coburg
Dodson
Lost Lake
Waleston
Milk
Cole
Saco
Bowdoin
Beaverton
Hinsdale
Vandalia
Tampico
Strater
Malta
Wagner
FORT BELKNAP INDIAN RES
PHILLIPS
Phillips
Brookside
Lodgepole
Hays
Cleveland
Lloyd
VALLEY
Avondale
Larslan
DANIELS
West Fork
Ossette
SHERIDAN
Reserve
Dagmar
Medicine Lake
Homestead
Froid
Sog
Dowd
Bredette
Benrud
Lustre
Volt
ROOSEVELT
McCabe
Bainville
Glasgow
Nashua
Wolf Point
Poplar
Brockton
Culbertson
Lanark
Snowden
Fort Union
Oswego
Frazer
Wheeler
Ft Peck
Nickwall
RIVER
MISSOURI
FT PECK DAM
Mona
Andes
Nohly
48°
Elmdale
Sioux Pass
Girard
Fairview
2
N.
D
A
K.
St. Pauls
Content
Midale
Regina
Landusky
Zortman
First Creek
Sun Prairie
Trine
Leroy
Fort Peck Reservoir
Telegraph Creek
Fourchette
Haxby
Sand Creek
Vida
Axtell
RICHLAND
Lane
Enid
Lambert
Sidney
Paxton
Richey
MC CONE
Weldon
Ceekay
Legg
Winifred
Suffolk
Little Crooked
FERGUS
Moulton
Christina
Roy
Arrow
Fergus
Hilger
Danvers
Brooks
Maginnis
Fort
Hanover
Giltedge
Lewistown
Heath
Glasston
Grassrange
Teigen
Piper
Becket
Forestgrove
Valentine
Dovetail
PETROLEUM
Cat Creek
Winnett
Mecaha
Butte Creek
GARFIELD
Brusett
Big Jordan
Van Norman
Dry Creek
Redwater
Circle
Mink
Brockway
Watkins
Rimroad
DAWSON
Lindsay
Union
Stipek
Glendive
Olanda
Bloomfield
Crane
Savage
Burns
Intake
3
Sand Springs
Cohagen
Grisdella
Little
Mosby
Alice
Bruneida
Hillside
Hazel
Crow Rock
PRAIRIE
Hodges
Wibaux
Yates
47°
WIBAUX
Natal
Battrick
Tyler
Flat Willow
Rayfield
Musselshell
Elmer
Vanstel
Rock Springs
Angela
Marsh
Fallon
Terry
St Phillips
GOLDEN VALLEY
MUSSELSHELL
Living Sprs
Rothiemay
Emory
Wallum
Franklin
Melstone
Hibbard
Sumatra
Bascom
Ingomar
Ivanell
Porcupine
ROSEBUD
Blatchford
Mildred
Carlyle
Cabin Creek
Ollie
Zero
Kinsey
Shirley
Sutherland
Ismay
Westmore
Roundup
Gage
Delphia
Klein
Lavina
Barber
Ryegate
Cushman
Bundy
Belmont
Vananda
Sanders
Myers
Hysham
Pineview
Carterville
Thurlow
Sheffield
Paragon
Miles City
Horton
Hathaway
Rosebud
Forsyth
Howard
Locate
Knowlton
Foundation
Mizpah
Oneill
Plevna
Tonquin
Baker
FALLON
Willard
Webster
4
Broadview
YELLOWSTONE
Yellowstone
Bighorn
Custer
TREASURE
Moon Creek
CUSTER
Garland
Rapelje
Wheat Basin
Comanche
Acton
Worden
Nibbel
Pompeys Pillar
Ballantine
Shepherd
Osborn
Huntley
Lockwood
Corinth
Colstrip
Lee
Knobs
46°
Ekalaka
Mill Iron
Elgin
Belltower
Chalk Buttes
Ridgway
STILLWATER
Rimrock
Polytechnic
Wickett
Hesper
Yegen
Billings
Mossmain
Laurel
Columbus
Park City
Young's Pt
Rapids
Silesia
Absarokee
Joliet
Rockvale
Edgar
Boyd
Fromberg
Bridger
CARBON
Roberts
Roscoe
Red Lodge
Washoe
Bearcreek
Golden
Belfry
Bowler
Chance
Warren
Hardin
McRae
Maschetah
Sarpy
Brandenberg
Volborg
Coalwood
Powderville
Stacey
Loesch
POWDER RIVER
Camps Pass
Olive
Epsie
Sonnette
Broadus
CARTER
Capitol
Boyes
Pinkele
Hammond
Albion
Alzada
Little Missouri
Crow Agency
CUSTER BATTLEFIELD NAT'L MON
Garryowen
Busby
St. Xavier
Pryor
CROW
BIG HORN
INDIAN RESERVATION
Lame Deer
Ashland
TONGUE RIVER IND RES
Tongue
Birney
Otter
Selway
Sayle
Moorhead
Bay Horse
Biddle
Ranchcreek
Ridge
Bowers
Kirby
Lodge Grass
Wyola
Aberdeen
Decker
Tongue River Res
Quietus
Shriver
Dryhead
Hillsboro
45°
5
Lovell
Sheridan
W Y O M I N G
Cody
Shoshone Reservoir
Dead Indian Pk
Basin
Bighorn
BIGHORN MTS
Cloud Pk
Buffalo
Clear Creek
Powder
Greybull
Fork
6
G Greenwich 109°
H
108°
J
107°
K
106°
L
105°

Hunters Hot-springs	7	F 5
Huntley	268	H 5
Huson	75	B 3
Hysham	410	J 4
Inga	20	F 2
Ingomar	100	J 4
Intake	8	M 3
Inverness	360	F 2
Iron Mountain	3	A 3
Ismay	182	M 4
Ivanell		J 4
Jackson	82	C 5
Jardine	40	F 5
Jeffers	60	E 5
Jefferson City	100	E 4
Jefferson Island	50	E 5
Jennings	10	A 2
Jens	25	D 4
Joliet	410	G 5
Joplin	368	F 2
Jordan	800	J 3
Judith Gap	175	G 4
Kalispell	9,737	B 2
Kenilworth		F 2
Kevin	351	D 2
Kila	100	B 2
Kinsey	8	L 4
Kintla		B 2
Kirby	14	J 5
Klein	400	H 4
Knobs	33	M 5
Knowlton		L 4
Kolin	12	G 3
Korner	50	D 2
Koyl		D 3
Kremlin	160	F 2
Lake McDonald	1	B 2
Lakeview	18	E 6
Lambert	359	M 3
Lame Deer	400	K 5
Lanark	3	M 2
Landusky	65	H 3
Lane	25	M 3
Laredo	38	G 2
Larslan	159	K 2
Laurel	3,663	H 5
Laurin	110	D 5
Lavina	195	H 4
Lebo		F 4
Ledger	20	E 2
Lee		K 5
Legg	40	J 3
Lehigh	5	F 3
Lennep	25	F 4
Leroy	10	G 3
Lewistown	6,573	G 3
Libby	2,401	A 2
Lima	483	D 6
Limestone	43	F 5
Lincoln	250	D 4
Lindsay	57	L 3
Lingshire	50	E 4
Little Crooked	3	H 3
Living Springs	7	G 4
Livingston	7,683	F 5
Lloyd	5	G 2
Locate	4	L 4
Lockwood	200	H 5
Lodge Grass	536	J 5
Lodgepole	50	H 2
Loesch	10	L 5
Logan	172	E 5
Lohman		G 2
Lolo	210	B 4
Lolo Hot Sprs.	25	B 4
Loma	200	F 3
Lombard	26	E 4
Lonepine	9	B 3
Loring	50	J 2
Lost Lake	25	H 2
Lothair	72	E 2
Lothrop		B 4
Loweth	20	F 4
Lowry		D 3
Lozeau	12	B 3
Lupfer	8	B 2
Lustre	4	K 2
Luther	22	G 5
Madoc	33	L 2
Malta	2,095	J 2
Manhattan	716	E 5
Manicke	30	A 2
Manson		E 2
Marias	10	E 2
Marion	47	B 2
Marsh	100	M 4
Martinsdale	130	F 4
Marysville		D 4
Maschetah	25	J 5
Maudlow	50	E 4
Maxville	40	C 4
McAllister	21	E 5
McCabe	55	M 2
McElroy	2	M 2
McLeod	10	G 5
McRae	5	J 5
Meaderville	250	D 4
Mecaha		J 3
Medicine Lake	454	M 2
Meharry	4	J 2
Melrose	130	D 5
Melstone	195	H 4
Melville	29	F 4
Menard	20	E 5
Merino	5	F 3
Midale		H 3
Midby	7	M 2
Mike Horse	200	D 4
Mildred	75	M 4
Miles City	9,243	L 4
Mill Iron	75	M 5
Millegan		E 3
Milltown	750	C 4
Miner	53	E 5
Mink	30	L 3
Mission	20	F 5
Missoula	22,485	C 4
Mizpah		L 4
Moccasin	300	F 3
Mock (Radnor)	8	B 2
Moiese	8	B 3
Molt	25	H 5
Mona	25	M 3
Monarch	53	F 3
Monida	50	D 6
Montague	20	F 3
Moon Creek	80	L 4
Moore	224	G 4
Moorhead	15	K 5
Mosby	3	J 4
Mossmain	12	H 5
Moulton	50	G 3
Musselshell	250	H 4
Myers	37	J 4
Nashua	691	K 2
Natal	3	G 4
Navajo	7	M 2
Neihart	289	F 4
Nelson	50	E 4
New Chicago	20	C 4
Niarada	4	B 3
Nibbe	20	H 4
Nickwall		L 2
Nihill	2	G 4
Nimrod	45	C 4
Ninemile		B 4
Nohly	57	M 3
Norris	100	E 5
Noxon	113	A 3
Nyack	40	C 2
Nye	3	G 5
Oilmont	250	E 2
Oka		G 4
Olanda		L 3
Olive	6	L 5
Ollie		M 4
Olney	147	B 2
Oneill		L 4
Opheim	383	K 2
Osborn		H 5
Ossette		L 2
Oswego	100	L 2
Otter	57	K 5
Outlook	235	M 2
Ovando	100	D 3
Oxford	10	G 4
Pablo	150	B 3
Paola		C 2
Paradise	300	B 3
Paragon		K 4
Park City	450	H 5
Paxton	20	L 3
Peerless	125	L 2
Pendroy	80	D 2
Perma	60	B 3
Philipsburg	1,048	C 4
Phillips	35	H 2
Piedmont	21	D 5
Pine View		J 4
Piniele	10	M 5
Pioneer		D 4
Piper	6	G 4
Pipestone Hot Springs	12	D 5
Placer		E 4
Plains	714	B 3
Plentywood	1,862	M 2
Plevna	247	M 4
Polaris	25	C 5
Polebridge	56	B 2
Polson	2,280	B 3
Polytechnic	250	H 5
Pompeys Pillar	200	J 5
Pony	185	E 5
Poplar	1,169	L 2
Portage	22	E 3
Post Creek	10	C 3
Potomac	65	C 4
Powderville	4	L 5
Power	75	E 3
Pray	14	F 5
Proctor	125	B 3
Pryor	70	H 5
Quartz	4	B 3
Quietus	3	K 5
Race Track	20	D 4
Radersburg	110	E 4
Radio	100	B 3
Radnor (Mock)	8	B 2
Ramsay	131	D 5
Ranchcreek		L 5
Rapelje	150	G 5
Rapids		G 5
Ravalli	190	B 3
Rayfield	11	G 4
Raymond	50	M 2
Raynesford	45	F 3
Red Lodge	2,730	G 5
Redstone	105	M 2
Redwater		L 3
Reedpoint	150	G 5
Regina		J 3
Renova	6	D 5
Reserve	215	M 2
Rexford	200	A 2
Richey	595	L 3
Richland	120	K 2
Ridge	50	M 5
Ridgway	3	M 5
Riebeling		D 3
Rimini		D 4
Rimroad	20	L 3
Rimrock		H 5
Ringling	135	F 4
Riverdale	50	E 3
Rivulet	47	B 4
Roanwood	3	K 2
Roberts	200	G 5
Rock Springs	1	K 4
Rockvale	10	H 5
Rocky Boy	50	G 2
Rollins	200	B 3
Ronan	1,251	C 3
Roscoe	75	G 5
Rosebud	125	K 4
Ross Fork		G 3
Rothiemay	55	G 4
Round Butte		B 3
Roundup	2,856	H 4
Roy	175	H 3
Rudyard	521	F 2
Rumble Creek	30	C 3
Ryegate	339	G 4
Saco	539	J 2
Saint Ignatius	781	C 3
Saint Pauls	70	H 3
Saint Peter		E 3
Saint Phillips	6	M 4
Saint Regis	500	A 3
Saint Xavier	150	J 5
Salem		E 3
Saltese	95	A 3
Sand Creek		L 3
Sand Springs	12	J 3
Sandcoulee	500	E 3
Sanders	40	J 4
Santa Rita	145	D 2
Sappington	34	E 5
Sarpy	5	J 5
Savage	300	M 3
Savoy	15	H 2
Sayle	10	L 5
Scobey	1,628	L 2
Sedan	6	F 4
Seeley Lake	250	C 3
Selma	7	E 2
Selmes	6	G 5
Selway	4	K 5
Shambo		G 2
Shawmut	122	G 4
Sheffield		K 4
Shelby	3,058	E 2
Shepherd	100	H 5
Sheridan	572	D 5
Shirley		L 4
Shonkin	6	F 3
Shriver	10	H 5
Sidney	3,987	M 3
Silesia	50	H 5
Silver Star	55	D 5
Silverbow	50	D 5
Simms	250	E 3
Simpson		F 2
Sioux Pass	40	M 3
Sipple		G 4
Sixteen	10	F 4
Sloan		B 3
Snowden	16	M 2
Somers	750	B 2
Sonnette	5	L 5
Soo		L 2
Southern Cross	50	C 4
Spion Kop	10	F 3
Springdale	75	F 5
Springhill		F 5
Square Butte	75	F 3
Stacey	7	L 5
Stanford	542	F 3
Stark	25	B 3
Stevensville	772	C 4
Stipek	50	M 3
Stockett	300	E 3
Stone		C 4
Stonehill	5	A 2
Strater		J 2
Straw	25	G 4
Stryker	60	B 2
Suffolk	14	G 3
Sula	112	B 5
Sumatra		J 4
Sun Prairie		J 3
Sun River	115	E 3
Sunburst	845	E 2
Superior	626	B 3
Sutherland		L 4
Swan Lake	100	C 3
Sweetgrass		E 2
Swingley		F 5
Taft	2	A 3
Tampico	80	K 2
Tarkio	75	B 4
Teigen		H 3
Telegraph Creek	5	J 3
Terry	1,191	L 4
Teton		F 3
Thoeny	10	K 2
Thompson Falls	851	A 3
Three Forks	1,114	E 5
Thurlow		K 4
Tonquin		M 4
Toston	100	E 4
Townsend	1,316	E 4
Trailcreek	10	B 2
Trego	48	B 2
Trident	150	E 5
Trine		H 3
Trout Creek	52	A 3
Troy	770	A 2
Tunis	6	F 3
Turner	200	H 2
Tuscor	4	A 3
Twin Bridges	497	D 5
Twodot	150	F 4
Tyler	3	H 4
Ulm	150	E 3
Union	50	L 3
Ural	37	A 2
Utica	60	F 4
Valentine	3	H 3
Valier	710	D 2
Van Norman	4	K 3
Vananda	100	K 4
Vandalia	25	J 2
Vanstel		K 4
Varney	12	E 5
Vaughn	190	E 3
Verona		F 2
Victor	350	B 4
Vida	58	L 3
Virgelle	20	F 2
Virginia City	323	E 5
Volborg	7	L 5
Volt	35	L 2
Wagner	50	H 2
Waleston		J 2
Walkerville	1,631	D 4
Wallum		G 4
Waltham	25	E 3
Ware	4	G 3
Warland	90	A 2
Warmsprings	2,000	D 4
Warren	40	H 5
Warrick	3	G 2
Washoe		G 5
Waterloo	95	D 5
Watkins	10	K 3
Webster	2	M 4
Weldon	2	K 3
West Fork		L 2
West Gallatin		E 5
West Glacier	440	C 2
West Yellow-stone	500	E 6
Westby	396	M 2
Westmore	16	M 4
Wheat Basin	10	G 5
Wheeler		K 2
White Sulphur Springs	1,025	E 4
Whitefish	3,268	B 2
Whitehall	929	D 5
Whitepine	175	A 3
Whitetail	240	L 2
Whitewater	85	J 2
Whitlash	18	E 2
Wibaux	739	M 3
Wickes	70	D 4
Wickett		H 5
Wilborn		D 4
Willard	3	M 4
Williams	10	D 2
Willow Creek	300	E 5
Wilsall	300	F 5
Windham	116	F 3
Winifred	217	G 3
Winnett	407	H 4
Winston	53	E 4
Wisdom	125	C 5
Wise River	50	C 5
Wolf Creek	156	D 3
Wolf Point	2,557	L 2
Woodside	100	B 4
Woodworth	45	C 3
Worden	375	H 5
Wyola	110	J 5
Yaak		A 2
Yakt	28	B 2
Yates		M 4
Yegen	10	H 5
Youngs Point		G 5
Zero	22	L 4
Zortman		H 3
Zurich	85	G 2

THE COPPER-DOMED CAPITOL OF THE "TREASURE STATE"



Montana's Statehouse overlooks the city of Helena. Its dome is covered with copper, one of the most valuable minerals in the state. Montana is a leading copper producer in the nation. Atop the dome is a reproduction of the Statue of Liberty.

in the east. Largest of the dams built in the state for power, irrigation, and other purposes is Fort Peck Dam (1940) on the Missouri River. It is the largest dam in volume in the world (*see* Dam). On the Flathead River is Kerr (Polson) Dam (1938), and on the south fork of the river is Hungry Horse Dam (1952), the third highest dam in the United States. Under construction are Canyon Ferry Dam on the Missouri and Tiber Dam on the lower Marias.

Most of Montana's manufacturing is based on its natural resources. These include copper, lead, and zinc smelting, lumber sawing and planing, and the manufacture of beet-sugar and grain-mill products.

Approximately 2 million tourists each year find recreation in Montana's beautiful mountains and national forests and on its dude ranches. They spend about 70 million dollars annually and provide an important source of income.

Great Variety of Climate

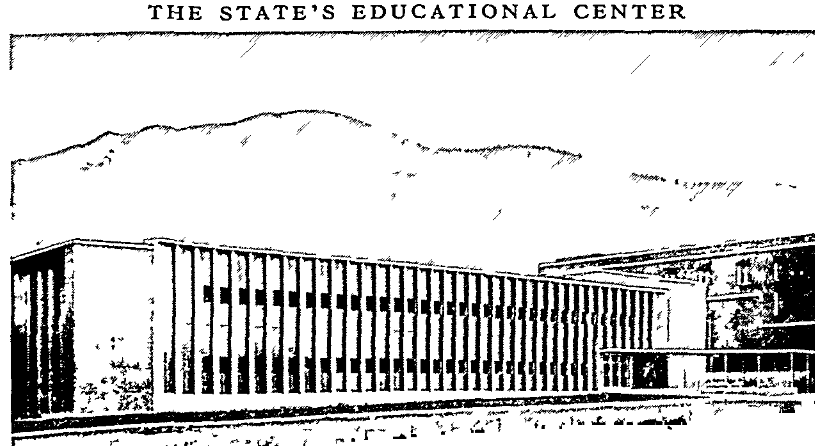
The great size and varying altitudes of the state give it a diversified climate. In the eastern section temperatures are extreme. The highest recorded temperature is 117° F.; the lowest, −70°. Rainfall averages from 10 to 15 inches a year. The isolated mountain groups get more moisture, with frequent local thundershowers. In the western section winters are more moderate, summers cooler, and rainfall heavier than in the semiarid east. The climate as a whole shows great changeability. Sudden fierce storms from the north may be followed by warm, dry Chinook winds from the southwest. The effect, however, is very healthful.

The Leading Cities of the State

Most of Montana's largest cities are in the western half of the state. First in population is Great Falls. It lies at the center of a large irrigated region. Several falls on the Missouri River generate electric power for its industries, including a huge copper and zinc refinery and wire plant. Butte is a world-famous mining center, producing copper, zinc, lead, manganese, gold, and silver. The city is the home of the Montana School of Mines. Billings, largest city in the eastern part of the state, is a railroad, industrial, and distributing center for a rich agricultural region. Rocky Mountain College and Eastern Montana College of Education are here.

Missoula, the Garden City, is situated at the junction of three valleys. Farming, fruit growing, lumbering, and mining are the chief activities of the surrounding country, and the city has lumber mills, railroad shops, and a beet-sugar factory. It is the seat of the Montana State University. This institution and the Montana State College at Bozeman, the Montana School of Mines at Butte, the Western Montana College of Education at Dillon, the Eastern Montana College of Education at Billings, and the

THE STATE'S EDUCATIONAL CENTER



The School of Music building of Montana State University at Missoula is in contemporary architecture. Above it on Mount Sentinel is the school's symbolic "M."

Northern Montana College at Havre make up the University of Montana.

Helena, the state capital, is picturesquely situated amid the Rockies. It is a supply and resort center in a rich mining and farming area. Millions of dollars of gold have been taken from its main street and nearby gulches. Carroll College, a Catholic school for men, is located here (*see* Helena).

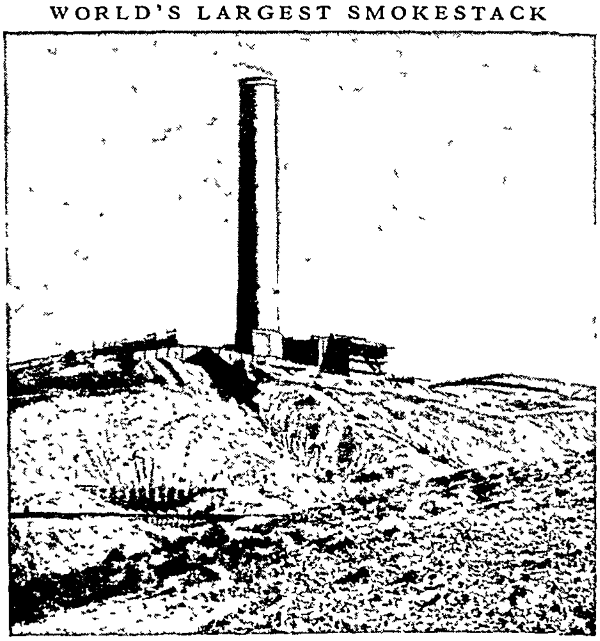
Bozeman is in a productive grain and livestock-raising region in southwestern Montana. It is also a recreation center on a scenic route to Yellowstone National Park. Anaconda, 25 miles northwest of Butte, is noted for its copper-smelting works. Near Flathead Lake is Kalispell, a tourist and trade city in a prosperous agricultural valley.

A Struggle for Law and Order

In the days when great numbers of people were entering Montana in search of gold and silver, it was difficult to maintain law and order. Each settlement tried to govern itself, but bands of outlaws often terrorized the mining camps and plundered stagecoaches on the lonely roads. The need for effective government was met in 1864 when Congress created Montana Territory. The first territorial legislature assembled at Bannack and chose Virginia City as the seat of government. In 1876 Col. George Armstrong Custer, with a detachment of 208 United States cavalrymen, met a tragic end on the Little Bighorn. About 6,000 Sioux Indian warriors, led in revolt by Sitting Bull, surrounded Custer and his men and massacred them. On Nov. 8, 1889, Montana was admitted to the Union with Helena as the capital.

The present population is a cosmopolitan mixture from almost every state in the Union, Canada, and many European countries. A considerable part of the people are of foreign birth, and in some communities European customs are occasionally observed. There are about 17,000 Indians in the state, the majority located on seven reservations. (*See also* chronology in Montana Fact Summary; United States, sections "Great Plains" and "Rocky Mountains.")

WORLD'S LARGEST SMOKESTACK



At Anaconda is one of the world's biggest copper smelters. Its 585-foot brick smokestack releases fumes high above the ground.

MONTCALM, MARQUIS LOUIS JOSEPH DE (1712-1759). The name of Montcalm, the commander of the French troops in Canada in the French and Indian War, is inseparably linked with that of James Wolfe, the British commander. They were the two principal actors in that spectacular drama which decided that North America was to be chiefly English-speaking and not French and that it was the self-governing institutions of England which were to prevail and not the absolutism of France. Though Montcalm suffered defeat and death in the conflict, his name stands as high in history as does that of Wolfe, his conqueror. In Quebec today there stands a monument to the two heroes, bearing this inscription: "Valor gave them a common death, history a common fame, and posterity a common monument." (*See* Wolfe.)

Montcalm had entered the army of France at the age of 14 and had risen to the rank of colonel by the time he was 24. Ten years later he was sent to America, with the rank of brigadier general, to command the French troops in that theater of the world-wide war with the British. He won victories at Oswego, Fort William Henry, and Ticonderoga. But at Quebec Wolfe proved himself the better general, and the French were defeated on the Plains of Abraham, west of the city. Montcalm, as well as Wolfe, was mortally wounded during the battle; when told that he could not live, he replied: "Thank God! I shall not live to see the surrender of Quebec."

MONTE CARLO (*mŏn'tē kär'lō*), **MONACO**. The picturesque resort of Monte Carlo, on the Mediterranean coast near where France and Italy meet, has been supported by gambling since the middle of the 19th century. Cards, roulette, and other games have paid for the splendid buildings, gardens, and lawns that look out from a promontory high above the sea.

The most splendid building of all is the Casino, or gambling hall, with gleaming white walls, tiled roofs, and luxurious salons. Men and women from all over the world—royalty, the rich, and the venturesome—have gathered here each night. They have crowded about the roulette tables at the croupier's signal: "*Faites vos jeux, messieurs!*" (Make your plays, gentlemen!). They have tried their luck at the card games, *trente et quarante*, *écarté*, *baccarat*, and many others. They have excitedly placed bets on the miniature horse race, *les petits chevaux*.

In some of the games, the stakes were set at thousands of francs, and many gamblers bet beyond their means. Despair and death have followed a spin of the roulette wheel or the turn of a card.

The Casino, its wide terrace fronting the sea, has been the center of the life of the little city, with its long street of Parisian shops and many little tea rooms. Monte Carlo and two other towns, Monaco and La Condamine, cover practically all the terri-

tory of the independent principality of Monaco, ruled by the prince of Monaco. His tiny realm, dotted with lovely gardens and magnificent villas, occupies the very fringe of the foot of the Alps and two promontories, an area of less than 370 acres. Because gambling yields a large revenue the people do not pay taxes. None of the prince's subjects is allowed to gamble in the Casino.

The town of Monaco retains its ancient battlemented walls and bastions. It centers about the prince's palace and is reached by tramway or by long flights of steps. Nearby are the cathedral and the world-famous Oceanographic Museum. The population of Monte Carlo is 7,967 (1946 census); of the principality of Monaco, 20,202 (1951 census).

MONTESSO'RI, MARIA (1870–1952). Modern education owes much to an Italian psychiatrist named Maria Montessori. Early in the 1900's she proposed a "progressive" method of education called the Montessori Method. Under it the child himself chooses what he wishes to learn from the learning tools provided. Much that is learned is an experience of one or more of the five senses. Thus education is self-acquired. The child's interest is sustained by his feeling of accomplishment and by his pleasure in working at and with the things he likes.

Maria Montessori was born Aug. 31, 1870, near Ancona, Italy. In 1894 she became the first woman to win a medical degree from the University of Rome. After graduation she worked among feeble-minded and retarded children. Her progressive method developed from this work and from her experiences as director of a school for normal children called *Casa dei Bambini* (Children's House). Dr. Montessori was called to many parts of the world to lecture on her method. Over the years it has been further developed and in some respects altered by other educators. Among her best-known books are 'The Montessori Method' (1912) and 'The Secret of Childhood' (1939).

During the second World War, Dr. Montessori was interned in India as an enemy alien. Upon her release she returned to Italy. She died in the Netherlands May 7, 1952.

MONTEVIDEO, URUGUAY. One third of the people of Uruguay live in Montevideo, the capital and only large city. It is situated at the mouth of the Plata River, the outlet of a grazing and agricultural area. The small peninsula it occupies encloses one of the few good harbors on the continent.

The city was founded in 1726 by colonists from Buenos Aires. It was named Montevideo ("I see the mountain") because of a cone-shaped hill, the Cerro, on the mainland. The old section lies on a low, rocky headland between the ocean and the bay. The newer part spreads back to the mainland, around the Cerro, and to the east shore of the bay. A beautiful boulevard, the Avenida 18 de Julio, extends from a plaza at the junction of the old and new sections to the suburbs. Here are the impressive Government Palace, Palacio Salvo, and Municipal Palace. Skyscraper office buildings, the cathedral, and the university are of interest. Montevideo's parks are notable for their rose gardens, and in one is a famous monument to the covered wagon. East of the city a fashionable promenade, lined with villas and hotels, stretches for miles along the beach.

Millions of dollars have been spent on modern port facilities. Railways and highways fan out from Montevideo to the interior. Cattle, sheep, and hogs are brought to the city for slaughter; there they are frozen, salted, or canned for foreign shipment. Montevideo has woolen mills, tanneries, shoe factories, and flour mills. The chief exports are meat, wool, hides, and flaxseed. Population (1943 estimate), 708,233; (1950 estimate), 850,000.

MONTFORT, SIMON DE (1208?–1265). What is usually called England's "first Parliament" was summoned in 1265 by the statesman and general Simon de Montfort. To this council he called not only the barons, clergy, and some knights, as had been done in the past, but also two townsmen from each of the cities and towns that supported his effort to reform Henry III's misrule.

Little is known of De Montfort's childhood. He was a younger son of a French noble, Simon de Montfort IV, and inherited his English title, Earl of Leicester, through a grandmother. In 1230 the young Frenchman came to England to press his claim for the title. He soon became a favorite of King Henry III and married the king's sister.

At first the English barons distrusted him because of royal favor and his foreign birth. On a crusade for the recovery of Palestine, he won renown as an administrator and military commander. He was devout and ambitious, but he had a fierce and overbearing temper. After his return to England, he took part in politics. About 1248 Henry appointed him governor of his French possession of Gascony. De Montfort suppressed the Gascon lords with an iron hand. They complained to Henry, and though De Montfort remained governor for some years, he lost royal favor.

Upon his return to England, he became the leader of a group of barons who were dissatisfied with Henry's misrule. They forced the king to promise reforms. Probably it was at this period that Henry, taking shelter from an electric storm at De Montfort's house, exclaimed: ". . . I fear thee more than all the thunder and lightning in the world."

The king violated his promises of reform, and De Montfort and his party resorted to arms. At Lewes, in the south of England, De Montfort and his barons captured Henry and his son Prince Edward.

Soon after the "first Parliament," Edward escaped and raised a force of nobles who were against De Montfort's harsh rule and his alliance with Llewellyn of Wales (not then English territory). The prince attacked De Montfort's force at Evesham, in west England. De Montfort lost both the battle and his life.

Simon de Montfort and his wife Eleanor had four sons, one of whom also was slain at Evesham. The reforms instituted by De Montfort were continued under the wise Prince Edward, later Edward I.

MONTGOMERY, BERNARD LAW (born 1887). Slim, mustached Bernard Montgomery became Britain's most noted general in the second World War. He commanded the Eighth Army in its triumphant sweep across North Africa and in its invasion of Sicily and Italy. He was promoted to field marshal and created Viscount of Alamein in honor of his African victory.

Montgomery was born Nov. 17, 1887, in County Donegal, Ireland. Soon after his birth his father, a bishop of the Anglican church, was sent to Tasmania. Bernard decided on a military career when he saw Australian soldiers depart for the Boer War. In 1908 he graduated from Sandhurst, the British officers' school.

In the first World War the young officer was twice wounded and was decorated by both his own and the French governments. After the start of the second World War, he commanded a division in France. He took part in the heroic rescue of British and Allied troops from the beach at Dunkirk.

Following his Mediterranean service Montgomery commanded all Allied ground forces in the June 1944 invasion of France until after the breakthrough at the base of the Cherbourg peninsula. He then commanded the group of armies that swept across northern France and into Belgium and the Netherlands.

In 1946 he was made chief of the British Imperial Staff and in 1948 the military chief of five Western European nations. In 1951 he became deputy commander of the military forces of the Atlantic Pact nations. (*See also* World War, Second.)

MONTGOMERY, ALA. At the outbreak of the Civil War, delegates from the seceding states met in Montgomery and formed the Confederate States of America. The city was the new nation's capital from February to May 1861, when Richmond, Va., became the seat of government. Jefferson Davis took oath as president on the Capitol porch on Feb. 18, 1861. The place is now marked with a six-pointed star. The city is called the "Cradle of the Confederacy."

Montgomery spreads over several hills along the Alabama River. In the heart of the city is Court Square. To the east, at the end of Dexter Avenue, the Capitol Building rises on Goat Hill. Its central part was completed in 1851. Three great wings have been added. Nearby are the modern Highway Department, Archives and History, and Department of Justice buildings, and the White House of the Confederacy. Near the city are a state prison, a veterans' hospital, and Maxwell Air Force Base.

Montgomery was incorporated as a town in 1819 with the joining of two villages which were settled in 1817. It was named for Richard Montgomery, a Revolutionary War general. Cotton ginning and such industries as lumbering and flour milling soon became important. The state capital was moved from Tuscaloosa to Montgomery in 1846. The legislature first met here in 1847. During the Civil War the city was not taken until April 1865.

Recovery from the war was slow. Present manufactures include wood products, building materials, textiles, and glass. Montgomery is also a livestock-packing center. The city government is the commission form. (*See also* Alabama; Confederate States of America.) Population (1950 census), 106,525.

MONTH. The words "month" and "moon" are closely related. A month was originally the time between two new moons. Today astronomers call this length of time the *synodic*, or *lunar*, month. Its average length is 29 days, 12 hours, 44 minutes, and 2.8 seconds, but it varies nearly 13 hours. Actually the moon travels around the earth in 27 days, 7 hours, 43 minutes, 11.5 seconds; this is the *sidereal* month. The reason for this time difference is explained in the article Moon.

Calendar months differ in length, as indicated by the old rhyme, of which one version runs:

Thirty days hath September,
April, June, and November;
All the rest have thirty-one,
Excepting February alone,
To which we twenty-eight assign
Till leap year brings it twenty-nine.

In computing interest, 30 days is usually taken as a month. (*See also* Calendar; Year; and articles on the various months.)

MONTPELIER, VT. Vermont's capital was settled in 1787 by a group of Revolutionary War veterans under the leadership of Col. Jacob Davis. He named it Montpelier, after the French city of Montpellier. It was selected as the state capital in 1805 because it lay near the center of the state.

Montpelier is at the junction of the Winooski River and its tributary, the North Branch. It lies amid pleasant wooded hills in the heart of the Green Mountains. Its most important buildings rise about Capitol Square. Here the gold-domed granite State House, erected in 1836 and since enlarged, rears before a wooded hill over which spreads Hubbard Park. The Supreme Court Building houses the state historical museum and libraries as well as some state departments; it lies to one side of the State House. Facing the State House from across the square is the State Office Building. Washington County Courthouse, red brick with white stone trim, was erected in 1832. The Vermont Junior College was until 1936 known as Montpelier Seminary. Wrightsville Dam, on the North Branch, protects the city from spring floods.

Montpelier's workers are employed in state offices, in the headquarters of several insurance companies, and in the granite quarrying industry. It was chartered a city in 1895. It has the mayor-council form of government. Population (1950 census), 8,599.

MONTREAL (*mŏn-trē-ôl′*), **QUEBEC.** On May 18, 1642, a little band of French colonists and missionaries landed on the island where the St. Lawrence and Ottawa rivers meet. Mass was celebrated by Father Vimont. When the service was concluded he declared to the kneeling group: "You are a grain of mustard seed that shall rise and grow until its branches overshadow the land." Thus began the great city of Montreal, the second largest in Canada, and one of the largest inland seaports in the world.

The settlers had come from France under the leadership of Paul de Chomedy, Sieur de Maisonneuve, to

establish a mission in the midst of the Iroquois Indians. They named their settlement Ville Marie de Montreal. On the same site had once stood an Indian village, Hochelaga, discovered by Jacques Cartier in 1535. Cartier had christened the mountain above the village Mont Royal and raised a wooden cross on its summit. Today an electrically lighted cross 100 feet high stands on approximately the same site. Three-fourths of the people are still French-speaking and adherents of the Roman Catholic faith. In 1760 the British took possession of the city and began to develop the commerce and trade they control today.

Montreal lies on the southeast side of the island of Montreal (30 miles long by 7 to 10 miles wide), at the break in river transportation caused by the Lachine Rapids. Although it is nearly a thousand miles from the Atlantic, it is reached by ocean-going vessels about eight months of the year. The harbor extends for about 16 miles along the St. Lawrence. At the upriver end of the docks begins the system of canals leading to the Great Lakes, making transportation possible for another thousand miles into the interior of the continent. Communications by water, rail, and highway reach northwest along the Ottawa River and south through the Lake Champlain-Hudson River valley to New York City.

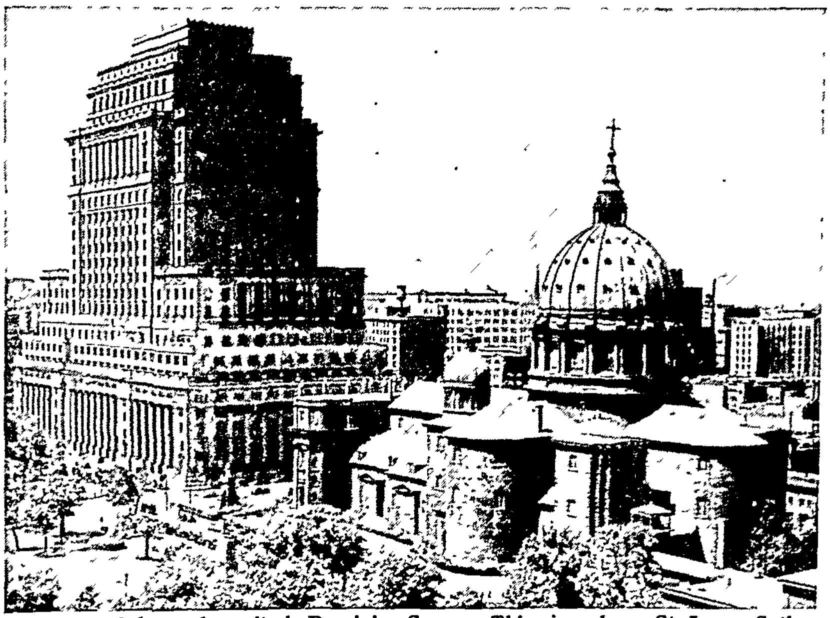
Thus the city is an extremely important transshipment point. Huge grain elevators, cold-storage plants, and warehouses are part of the harbor equipment. Montreal is the export center for the wheat of the western prairies and for the lumber, wood pulp, bacon, butter and cheese which are produced in Ontario and Quebec. Raw materials from all over the world are unloaded at its docks for distribution to the country's manufacturing plants.

Manufacturing has the advantage of abundant, cheap hydroelectric power. Montreal leads the nation in the production of ready-made clothing and it is the style center of the country. Leather boots and shoes, electrical equipment, locomotives and railroad cars, flour, tobacco, and meat products are among the many manufactures. Shipbuilding and repairs are important. The fur auctions are among the largest in the world. Montreal is the headquarters of the country's leading railroads, banks, and insurance companies. St. James Street is Canada's financial center, corresponding to New York's Wall Street.

The city has a large tourist industry. Heavy snows make it popular with winter sports enthusiasts, and its old-world charm attracts visitors throughout the year. Mount Royal rises 763 feet in the center of the city. It is preserved as a natural park and no automobiles are permitted to enter. From the brow of the hill a beautiful view opens over the city. Westmount Mountain also provides fine panoramic views. On this mountain is St. Joseph's Oratory, built under the inspiration of the miracle-working Frère André. It is a shrine second in veneration only to Ste. Anne de Beaupré, near Quebec City.

Among the many buildings associated with the early history of Montreal are Notre Dame parish church and the Seminary of St. Sulpice, on the Place d'Armes; Château de Ramezay, built in 1705 and for many years the residence of the governors of Montreal; Notre Dame de Bonsecours Church, sacred to sailors; Hôtel Dieu Hospital, founded in 1644 by Jeanne Mance; and in the suburb of Point St. Charles, a stone farmhouse with its original furnishings, built in 1662 for Marguerite Bourgeoys, founder of the teaching order of the Congregation of Notre Dame. Montreal is the seat of McGill University and the University of Montreal (Roman Catholic). Population (1951 census), 1,021,520.

DOMINION SQUARE IN MONTREAL



The heart of the modern city is Dominion Square. This view shows St. James Cathedral (right) and the Sun Life Assurance Building (left). On the Square also are St. George's Church (Anglican), two hotels, and a skyscraper office building.

MOODY, DWIGHT LYMAN (1837–1899). As a young man Dwight Moody deserted a successful business career to devote his life to evangelism. He was born Feb. 5, 1837, in Northfield, Mass., one of nine children. At 13 he began to work, and when he was 17 he was a shoe clerk in Boston. Two years later he became a salesman in Chicago. He spent much time in bringing religion to slum people and in 1860 dropped business life to become a lay preacher. As an evangelist he traveled widely in Great Britain and the United States. His sermons were direct, forceful, and intimate. He was endowed with administrative and executive abilities and founded the Moody Bible Institute in Chicago, two schools, and a religious publishing firm. In 1862 he married Emma C. Revell; they had two sons and a daughter. He died Dec. 22, 1899, in Northfield.

The MOON—*Earth's* NEAREST NEIGHBOR

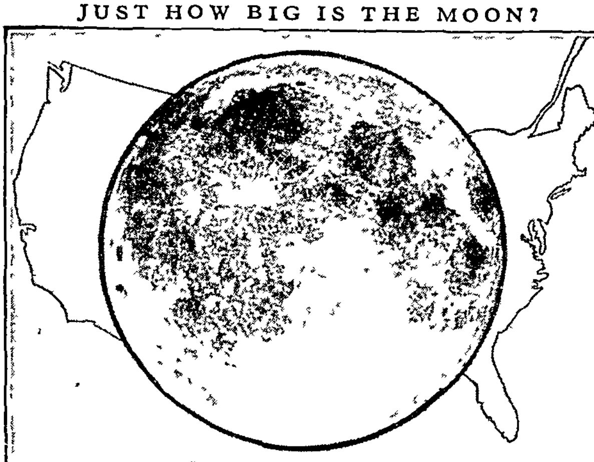
MOON. Of all celestial bodies, the moon is the nearest to us. With the naked eye we can see a definite pattern on its surface. Using a little imagination, we make this out to be the man in the moon, a girl, or a jumping dog. Often we see the moon in the daytime, looking like a pale wisp of white cloud. Then it shifts to the evening sky, and we can watch it night after night as it grows from a thin crescent to a full round disk. When we see it near the horizon it looks large and yellow; but it seems to shrink and pale to silver as it climbs the heavens.

Against the background of the sky the moon seems to travel slower than the rest of the heavenly bodies. Stars slide behind it and disappear, popping out again after an hour on the other side. Sometimes the sun itself slides behind it, and we see the strange and beautiful phenomenon called an eclipse.

The moon has had almost as many worshipers as the sun, and has inspired more poetry than any other celestial body. It has also given rise to more superstitions. But the moon is not concerned with our weather or our crops; it has work enough with the tides. It pulls up the waters of our oceans as the turning earth presents new surfaces to it, and lets them drop when they pass out of line (*see* Tide). The moon is a dead world, an opaque globe. Yet it serves as a giant mirror in the sky. After the sun has set for us, the moon still catches its golden glow and turns it into silver to light our nights.

The moon is a satellite, a hanger-on, of the earth, held captive by the force of gravity. It revolves around the earth once in about 28 days. The moon's diameter is a quarter of that of the earth (2,160 miles) and its area is roughly equal to the continents of North and South America. It is only a quarter of a million miles away—a mere step astronomically speaking. A 200-inch telescope brings it 10,000 times nearer, so that we see the moon as if it were only 25 miles away.

JUST HOW BIG IS THE MOON?



Here is how the moon would look if it were placed over the United States. It is only 2,160 miles in diameter, but it weighs 81 quintillion tons. (81 quintillion is 81 and 18 zeros.)

Moon Geography

We see the face of the "man in the moon," but never the back of his head. In other words, the moon (for reasons to be explained later) always shows the same side to the earth. We know the geography of that half of the moon which faces us nearly as well as we know the geography of the earth itself. All its principal mountains and plains were named long before the earth was fully mapped. The large patches which we see are level plains, probably covered with a dry ash. Early observers thought these deserts were seas, and gave them such fanciful names as Mare Serenitatis (the Serene Sea), Mare Imbrium (the Rainy Sea), Oceanus Procellarum (Hurricane Ocean), Lacus Mortis (Lake of Death), and so on. We now know that there is no water on the moon; but the old names are still used on lunar maps.

Narrow mountain ranges curve around the plains and catch the light of the sun, making a bright border with dark shadows around the large gray patches. The ranges in the Northern Hemisphere are called the Apennines, the Alps, the Caucasus, and the Carpathians. In the south the only important range is the Altai Mountains. A few peaks rise nearly as high as our Mount Everest. During a total eclipse of the sun, sunlight shining down valleys on the edge of the moon may form a circle of bright points called "Baily's beads."

Craters within Craters

The most surprising of the physical features of the moon are its craters. These are circular depressions with raised rims, steep on the inner side. They crowd the surface, overlapping one another, and small craters lie in the basins of the larger ones. More than 30,000 have been mapped, and there are probably hundreds of thousands too small to be observed from the earth. With our present telescopes we cannot see those less than two miles in diameter. The largest measure from 60 to 150 miles across.

From some of the craters—especially from Tycho and Copernicus—mysterious *rays* radiate for hundreds of miles like the spokes of a wheel. These brilliant white streaks do not seem to be light rays, since they cast no shadows and their straight lines are not broken when they cross mountains.

How were these craters formed? Astronomers cannot answer this question with certainty. One hypothesis, which gives them their name, holds that they are the craters of volcanoes, long since extinct. Another assumes that they were made by gigantic meteors striking the moon. Because the moon, unlike the earth, has no atmosphere to slow down or burn up falling meteors, they land with terrific impact (*see* Meteors and Meteorites). A third hypothesis, the bubble theory, suggests that when the moon was a molten mass, bubbles rose to the surface and exploded, as we see them do in boiling porridge.

A Visit to the Moon

Men have long dreamed of journeying to the moon. If this were possible, we should find the experience

This striking photograph was taken with the 100-inch reflector at Mt. Wilson. The picture shows the moon in natural position, and not upside down, as it would be seen through a telescope. The smooth area in the center is the Mare Imbrium (Rainy Sea), bounded below at the right by the Apennines. The shallowest and most prominent of the three craters at the right near the mountains is Archimedes. Directly above Archimedes, on the margin of Mare Imbrium, is the black, ring-like plain known as the crater Plato. If you look closely in the lower left-hand corner you can make out the dimly outlined crater Copernicus, one of the hugest of all. It is 46 miles across and is rimmed in by mountains 12,000 feet high. The smaller crater to the right above Copernicus is Eratosthenes.

anything but enjoyable. We should see a weird, strange, and terrifying world. All about us would be desolation and death, for there is no air to breathe. No flower grows, no bird sings, no insect creeps, no cloud sails across the sky. The meteors shower down, raising clouds of dust. But since there is no air, no sound breaks the stillness. No fire can be lighted for warmth or cooking. The rocks are sharp edged and the chasms steep, for no wind or water has ever smoothed their contours.

If it is day when we arrive, we see a white sun blazing. But with no atmosphere to diffuse its rays overhead the sky is black and the stars are visible (*see* Atmosphere). Striking the moon's surface with intensity, the sun's rays heat the rocks to more than 200°F. Except where mountains cast black shadows, the sun shines with dazzling brilliance.

The sun sets without twilight and we are plunged from scorching day into frigid night. The temperature of the rocks drops rapidly toward the extreme lower limit of cold (459.69° F. below zero). But if we are on the eastward side of the moon, we are not in darkness. Our own earth shines brightly in the sky.

Astronomers have proved that the moon has no atmosphere by watching starlight pass near the moon. The light does not refract as it does when entering the earth's atmosphere. Perhaps none ever formed there; but if it did the moon could not hold it. The earth's atmosphere is prevented from diffusing off into space by the force of gravity. But this force is only one-sixth as great on the moon as on the earth—too little to hold gases captive. Because of the difference in gravitational pull, a man who can jump 6 feet high on the earth could jump 36 feet high on the moon.

How Big Does the Moon Look to You?

When asked how big the disk of the full moon seems to them, most people compare it to a pumpkin, a basketball, a pie tin, or some other object ranging from 8 to 15 inches in diameter. Its brightness against the dark sky tends to exaggerate its size. The image of the moon in photographs always looks disappointingly small.

If you sight along a straight stick at the upper edge of the moon's disk and then drop to the lower edge, the stick moves through an angle of only one-half of a degree. A camera film which includes a 45° angle of view can with proper intervals of exposure show 90 images of the moon side by side without overlapping. A dime held at arm's length will more than cover the face of the moon.

When it is near the horizon the moon appears to be much larger than when it is high in the sky. But this is an optical illusion. A camera shows no difference in size. The illusion is caused by the workings of sight. All objects look bigger when viewed straight ahead rather than overhead where our eyes must be raised to see them. As our head tilts and our neck stretches, our eye muscles are drawn, and objects on high look smaller. It was once believed that we see objects on the horizon as larger, because there we have smaller objects for comparison. But this is disproved by the experience of every sailor who sees the moon "shrink" as it rises, even when he has nothing on the horizon for comparison.

The moon near the horizon often looks yellow or orange because the path of its light through the atmosphere is longer and part of the blue rays is scattered and lost (*see* Atmosphere). This difference in color helps to exaggerate the moon's size, since the so-called warm colors tend to make objects seem larger.

The Phases of the Moon

Except on the rare occasions when it is eclipsed by the earth's shadow, the moon is exposed to the full light of the sun, so that one half of it is always brilliantly lighted. But during its 28-day trip around the earth we see the full roundness of the lighted half only when the moon is on the side of the earth opposite to the sun. At other times we see only a part of the lighted face, ranging from a slightly lopsided disk to a thin crescent. Then when the moon is on the side directly toward the sun, we cannot see any part of the lighted face, and the moon seems to have disappeared. These various appearances and disappearances are called the *phases* of the moon. The diagram on the following page explains them.

Because the moon appears to us in such different shapes it has become a symbol of inconstancy. Thus Juliet says to Romeo:

> O! Swear not by the moon, the inconstant moon,
> That nightly changes in her circled orb,
> Lest that thy love prove likewise variable.

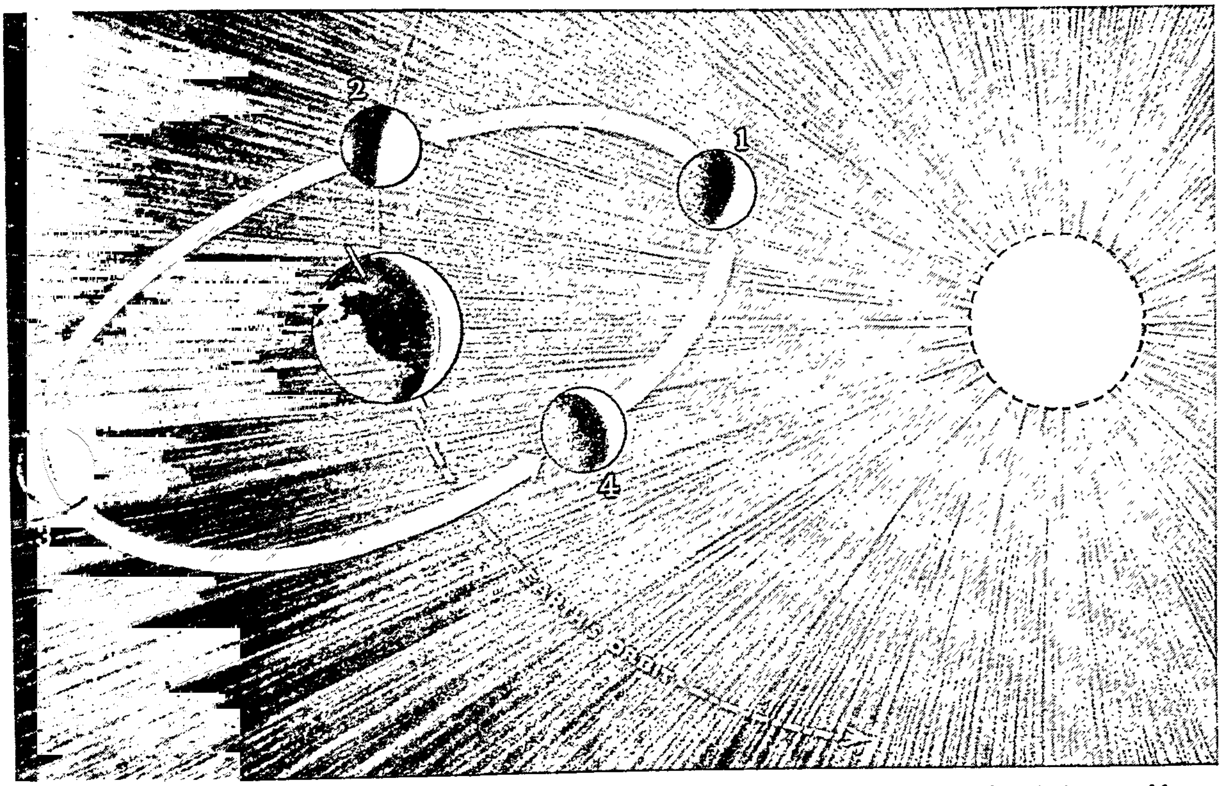
The fact that it has no fixed place in the heavens, but glides from star to star, has further added to its reputation for being fickle. But the moon is not so unreliable as some careless artists and writers would have us believe. Artists often paint moons that look very strange to astronomers; and the writer who has his heroine gazing at a crescent moon in the east should be sure to get her up just before dawn.

The new moon (popularly called the "dark moon") rises and sets at about the same time as the sun. It can be the subject of no pictured errors, since we never see it at all—except when it reveals itself dramatically by covering the face of the sun in a spectacular eclipse. Since it is not around at night, you can never see its shadow moving across the stars.

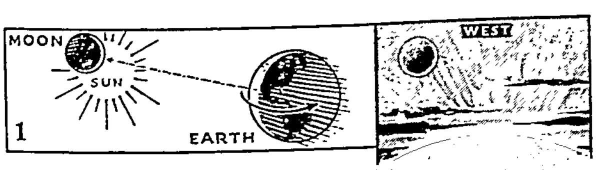
The waxing crescent (popularly called the "new moon"), is seen low in the western sky shortly after sunset. It rose shortly after the sun and has been in the sky nearly all day, but the sun has blinded us to it. An hour or two after sunset, it too vanishes over the horizon.

The first quarter (popularly called the growing "half moon") rises about noon, reaches its high point for the day at sunset and sets near midnight. Its round side is, of course, toward the west—the direction of its apparent movement across the sky.

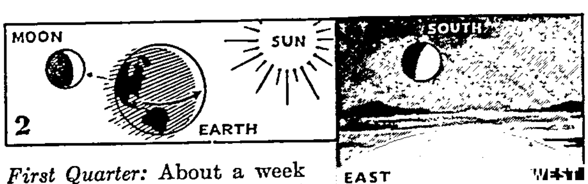
The full moon rises in the east as the sun sets in the west and is up all night long. It reaches its highest point about midnight. It is only in this phase that an eclipse of the moon is possible, for the earth is now between the sun and moon.



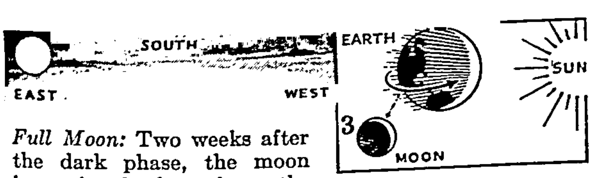
Because of the earth's rotation, the moon seems to move from east to west across the sky. But in its monthly revolution around the earth, the moon actually moves from west to east, or *against* the direction of its apparent nightly motion. The diagram above indicates these relative motions, and shows the phases, or visible appearances of the moon, which they create. They are (1) the new moon, which popularly means the first visible phase after the astronomical new moon; (2) the first quarter; (3) the full moon; and (4) the old moon. The diagram shows also how the orbit of the moon is tilted relative to the ecliptic—that is, the plane in which the earth revolves around the sun. Because of this tilt, dark and full moons usually are above or below the line between the earth and the sun. If they were not, eclipses would occur at these phases. Below we see the relative positions of the earth, sun, and moon at each phase, and also how the moon appears to us.



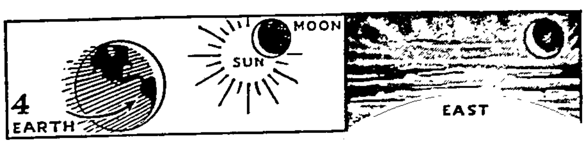
New Moon: When the moon is in line between the earth and the sun, its dark side is toward us and we cannot see it. A night or so later, the moon has moved enough to show the edge of its lighted side as a thin crescent, with tips or "horns" that point away from the sun. Since the moon is still nearly in line with the sun, it becomes clearly visible only for a short time after sunset. Then it dips below the horizon.



First Quarter: About a week later, the moon has moved far enough along its orbit to show half its lighted side to the earth. This growth in size is called *waxing.* The quarter turn around the earth now makes it rise at noon. By sunset it is visible high in the southern sky, and it sets about midnight. Because of the rotation of the earth the moon, like the sun, appears to move westward across the sky.



Full Moon: Two weeks after the dark phase, the moon is at its farthest from the sun. Its full lighted side is toward the earth. It has now moved halfway around its orbit, so that we see it *in the east* when the sun sets. The full moon is in the sky the whole night through, setting in the west about the time the sun rises in the east.



Old Moon: From now on the moon wanes. A week after full it reaches the phase called third quarter. Toward the end of the lunar month, it again swings to the side of the earth toward the sun. The crescent of the old moon appears in the east just before sunrise. Within a day or two it will disappear entirely.

The third quarter, or waning half-moon, rises about midnight, is highest at dawn, and sets about noon. You can see it in the morning in the west. Its round side is toward the east—opposite to the direction of its apparent movement.

The waning crescent—the last thin slice of the old moon—is visible for a day or two before the dark moon. It rises in the east shortly before the sun and soon disappears in the glare of the sunrise.

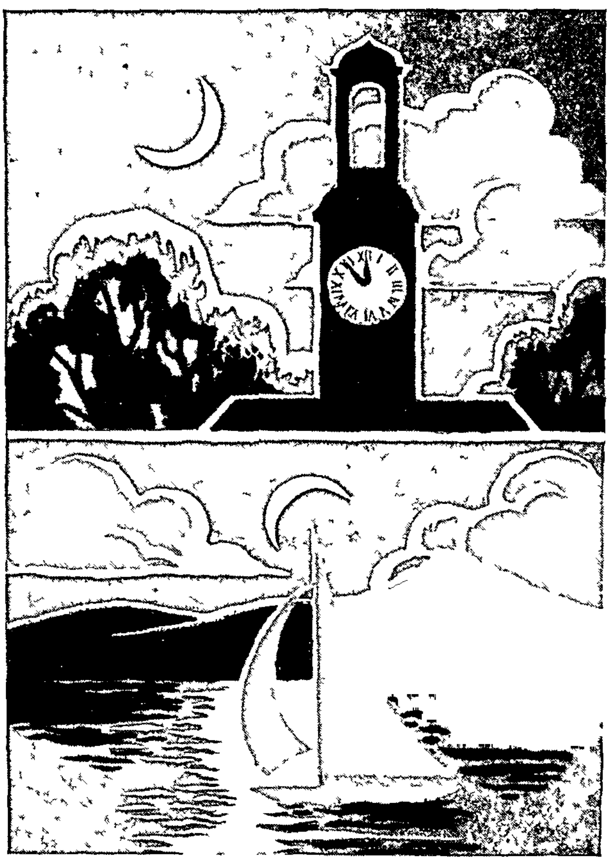
Between the full and the half phases, the face of the moon appears lopsided because of the bulge opposite the half circle. This is called the "gibbous" moon. The new gibbous moon rises after dawn and sets after midnight. The old gibbous moon rises after the sun has set and sets before dawn.

With these facts in mind, we are in a position to tell the approximate time of night by the moon. When Robert Browning in 'Meeting at Night' mentions "the yellow half-moon, large and low," we know the time is close to midnight. Either the waxing half-moon was rising or the waning half-moon was setting and both of these events always take place in the middle of the night.

The Horns of the Crescent Moon

The horns of the crescent moon always point *away* from the sun. Imagine a line joining the tips of the crescent. From this line imagine a perpendicular passing through the middle of the crescent. This will point exactly to the sun. Near the autumnal equinox (September 23) the thin new moon seen near the horizon after sunset is tilted so that a line joining the tips of the horns is nearly upright to the horizon. This moon will not "hold water," and is called a "dry moon." In spring the crescent of the new moon will be higher in the sky and almost directly over the place where the sun went down. The horns will be nearly parallel to the horizon, so that it looks as if it could "hold water" like a bowl. This is called the "wet moon." On rare occasions when a bank of clouds obscures the sun an hour or two after sunrise, but leaves a clear strip near the horizon, the new crescent moon may be seen with horns down. The same is true of the old crescent moon if the sun is blacked out an hour or two before sunset

WHAT'S WRONG IN THESE PICTURES?



Upper picture: a crescent moon is impossible in the middle of the night, it rises and sets within an hour or two of the sun. Lower picture: the horns of the moon always point away from the sun; it could appear like this only with the sun above it.

Artists sometimes place a star within the horns of the crescent; and Coleridge makes the same mistake in 'The Rime of the Ancient Mariner'—

> The hornèd Moon, with one bright star
> Within the nether tip

Of course no star can ever be seen there. Even though we see only a bright sickle of light, we must remember that the moon is a solid globe and that we cannot see through the dark part. Sometimes within the bright crescent we can actually see the rest of the disk, dimly illuminated. The crescent glows from sunshine and the rest is made visible by *earthshine*, the sunlight which is reflected to the moon from the daylight region of the earth. This appearance is called "the old moon in the new moon's arms."

Height of Moon in the Sky

The tilt of the earth on its axis accounts for the fact that the sun rides high in the sky in summer and low in the sky in winter (*see* Seasons). This tilt has a similar effect on the height of the moon in the sky; for, as we shall see later, the moon travels around the earth in a plane that, from the earth's point of view, is nearly in line with the sun. But since the moon makes a circuit of the earth each month, its changes in position from low to high take place every month. In what phase the moon will appear high in the sky and in what phase low depends, however, upon the seasons. Here is a general schedule:

New Moon. Since the new, or dark, moon lies between the earth and the sun, we should observe (if we could see it) that it rides extremely high in summer and extremely low in winter, just as the sun does, and that it reaches an intermediate height in spring and fall.

Full Moon. The full moon is always opposite to the sun. Therefore, in summer it is as low at midnight as the sun is at noon in midwinter, and it spends a relatively short time above our horizon. In winter it rises early and sets late, and at midnight it is as high in the sky as the sun is at noon in summer. In spring and fall it rides at an intermediate height.

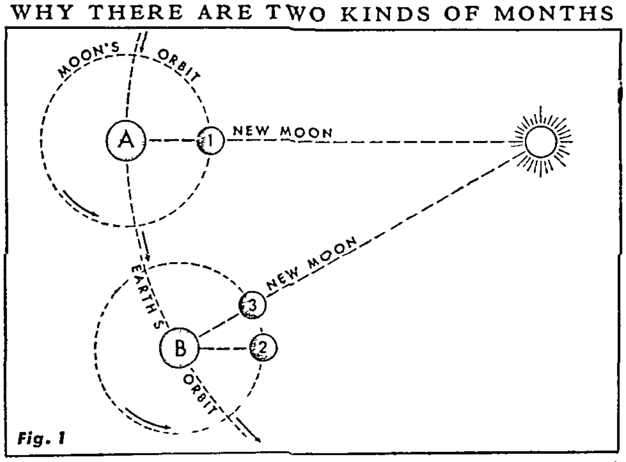
First and Last Quarters. The first-quarter moon rides low in the fall and high in the spring. The last quarter rides high in the fall and low in the

spring. Both the first and last quarters take a middle course in summer and winter.

Monthly and Daily Schedules of the Moon

We have said that the moon makes its journey around the earth in about 28 days. Actually the journey takes $27\frac{1}{3}$ days (the *sidereal* month). But the time between one new moon and the next is $29\frac{1}{2}$ days (the *synodic* or *lunar* month). Why this difference? Because during the moon's trip around the earth, it has also moved forward *with the earth* in the earth's journey around the sun. Thus the relative position of earth, moon, and sun is altered, and the moon has to travel farther to get once more into the position where it is completely dark (*see* Fig. 1).

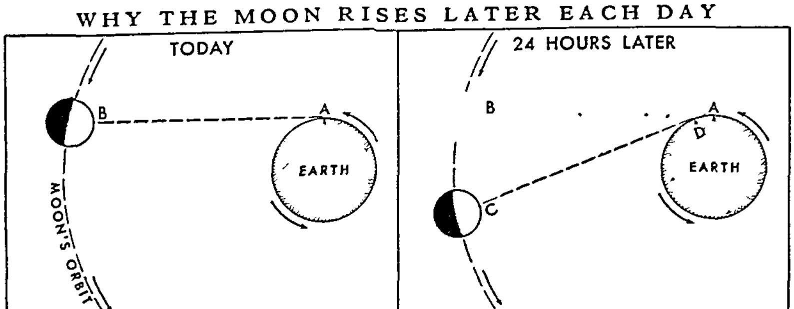
WHY THERE ARE TWO KINDS OF MONTHS



The moon going around the earth completes a circle (sidereal month) when it has moved from position 1 to position 2. But the earth meanwhile has traveled from *A* to *B;* so the moon cannot become "new" again until it reaches position 3 (lunar month).

In its daily schedule too the moon also shows peculiarities. On the average it rises about 50 minutes later each night or day. To understand this, we must recall that the moon, like the sun and stars, rises and sets because the earth rotates. Now, if the moon were "fixed" in the heavens, it would rise on the same schedule as the sun and stars. But the moon revolves around the earth, moving eastward in the same direction as the earth rotates. It makes a complete revolution in about 28 days, so it moves about 1/28th of the way from night to night. This motion takes it eastward against the background of the stars. If you observe closely, you can tell the exact time in the month by noting just where the moon is among the stars. Each night every point on the earth's surface must make more than a complete turn to bring the moon into view (*see* Fig. 2). Thus the moon rises later each night. During the 28 days the new moon is first in the west, close behind the setting sun. Then it moves eastward until the full moon rises in the east in early evening. Finally the waning crescent moon rises just before dawn.

WHY THE MOON RISES LATER EACH DAY



The moon rises today when the observer on the earth's surface reaches the position marked *A*. But tomorrow when the revolving earth brings him back to *A*, the moon traveling in its orbit has moved on from *B* to *C*. So the earth has to carry the observer to *D* before he can see the moon rise.

The moon's path around the earth—its orbit—is not in line with the earth's equator. Consequently the point at which it rises and the height it rides in the sky vary from day to day and from season to season. There is always some delay in the moon's rising. At latitude 40°, the range of this delay is from 13 minutes to 80 minutes. It is plain, then, that there are some calendar days when the moon does not rise at all. If it rose last night at 11:50 p.m., it will not rise tonight until after midnight.

The full moon nearest the autumnal equinox rises with the least delay of all, as if to help late-working harvesters. This is called the harvest moon. The full moon that follows it, the hunter's moon, is also an early riser.

Does the Moon Rotate on Its Axis?

The question of the moon's rotation on its axis is a matter of definition. Since the moon always shows the same side to us, the popular answer is that it does *not* rotate. If it did, we would see its surface moving around. But there is another point of view to be taken into account.

You can illustrate the moon's behavior in this respect by tying a string to the laces of a basketball and swinging it around your head in a circle. The laces will always be toward you.

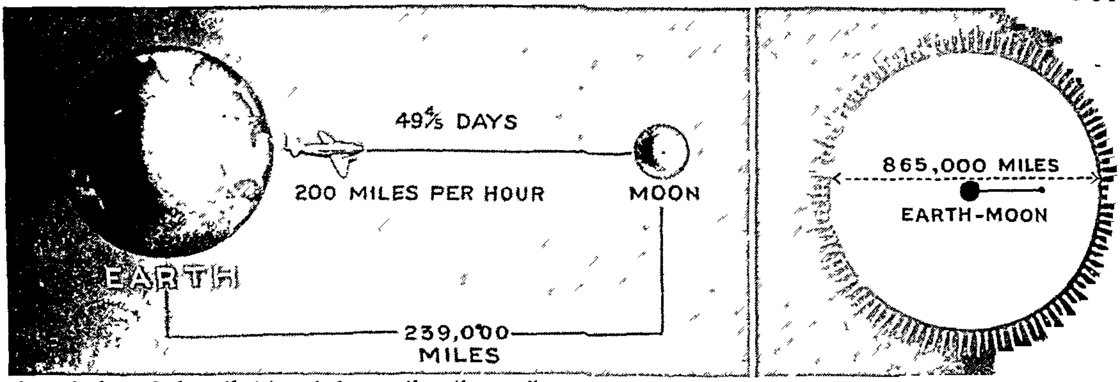
However, an observer standing *outside* the circle *could in the course of each swing around see all sides* of the basketball. The laced side, for instance, would show when the ball was on the far arc of its swing. The side opposite the laces would be visible when the ball passed nearest the observer. In the same way, an observer on the sun, for example, would see all sides of the moon. To him the moon would seem without question to be rotating on its axis. Astronomers try to describe the behavior of all heavenly bodies from the point of view of an "outside" observer. So they say that the moon makes one rotation on its axis during each 28-day revolution around the earth.

To put it another way, a dweller on the moon (if he could keep alive) would see the sun rise, cross the sky, disappear below the horizon, and then rise again—once during each trip around the earth. His "day" would be 28 *days* long instead of 24 *hours*.

The Moon's Orbit and the Eclipses

The moon does not follow a perfect circle in its path around the earth. Its orbit is an ellipse, with

HOW EARTH-MOON DISTANCES ARE DWARFED BY THE SUN



If you had an airplane that traveled more than three miles a minute, and if that airplane could, in some way, manage to fly across empty space, it would take you more than a month and a half to reach the moon. Perhaps this distance astounds you. But it is nothing compared with the next point in this picture. The diameter of the sun is more than twice the distance between the earth and the moon. If the earth were at the center of the sun, the moon could revolve around it and still remain inside the sun.

the earth nearer one end than the other. At the point called the *perigee*, when the moon is nearest the earth, its distance from the earth's center is 221,-463 miles. When it reaches the opposite point or *apogee*, the moon is 252, 710 miles from the earth's center. The image of the moon in a given telescope will be about 10 per cent larger at perigee than at apogee.

The moon's orbit does not line up with the earth's equator. Nor does it line up with the earth's path around the sun (the ecliptic). But it is nearer the latter—intersecting the plane of the ecliptic at an angle of about 5°. The two points at which the moon each month crosses the plane of the ecliptic are called the lunar *nodes*.

The situation is further complicated by the fact that the plane of the moon's orbit wobbles around continually as does a spinning coin just before it comes to rest. At a given season, for example, the side of the orbit which lies above (or north of) the ecliptic sometimes points away from the sun and sometimes toward it. This shift takes place slowly, the full cycle of oscillation occupying about 18½ years. This cycle is sometimes called the *regression of the nodes*, since the nodes move constantly westward around the ecliptic.

One of the results of this peculiar behavior of the moon's orbit is that at times it slants in the same direction as the earth's inclination to the ecliptic and at times in the opposite direction. This explains why the moon in some years may range farther north and farther south in the sky than in other years. In 1932, for example, the moon ranged 5 degrees farther north and farther south in the heavens than did the sun. A little over nine years later, in 1941, it was ranging north and south 5 degrees *less* than the sun.

The slant and wobble of the moon's orbit account also for the schedule of eclipses. These can take place only when the moon is in line with sun and earth, or very nearly so (*see* Eclipse). The moon can get into this position only when crossing the ecliptic—at a time when the crossing point or node happens to lie on the sun-earth line. Since the nodes are constantly swinging around, eclipses take place at irregular intervals and only repeat their cycle approximately every 18 years. During each cycle there are about 41 total or partial eclipses of the sun and 29 eclipses of the moon.

Other Irregularities of the Moon

Charting the course of the moon is one of the most difficult tasks in mathematical astronomy. Not only must the regression of the nodes be taken into consideration, but there are numerous small irregularities caused by the attraction of the sun and earth. For example, when the moon is between the sun and the earth, the sun tends to pull it away from the earth; and when the moon travels to the far side of the earth, the sun tends to pull it toward the earth. These irregularities are called *perturbations*.

Although the moon always turns the same face toward the earth, there are slight tippings back and forth of this face, called *librations*. Because of these, we can actually see considerably more than half of its surface—about 59 per cent.

Earth's Sister or Daughter?

Any theory of the origin of the moon naturally involves the beginnings of our entire solar system (*see* Earth). The theory which is now most generally accepted is the planetesimal hypothesis, or some modification of it. According to this theory, masses of gas were pulled away from the sun by a passing star, leaving millions of "planetesimals" whirling about it. By the action of gravity these were gathered into larger masses, forming the planets and their satellites, among them our moon. This theory would make the moon the sister of the earth.

The older nebular hypothesis would make the moon the daughter of the earth. According to this theory, the solar system was once a whirling gaseous nebula. The outer mass of the nebula took shape in the smaller masses of the planets; and in the same way the outer masses of the planets condensed into globular form, creating the moon and the satellites of the other planets in the solar system (*see* Planets).

Curious Facts and Superstitions

In ancient times people thought the changing moon exercised an important influence on their lives. The waning moon was supposed to bring bad luck. A daring enterprise was doomed to failure unless it was begun

under the benign influence of the full or the new moon. Sleeping in the moonlight was believed to cause insanity, and a person who lost his mind was said to be "moon-struck." "Lunacy" and "lunatic," as well as the slang word "loony," are derived from the name of the Roman goddess of the moon Luna.

Some farmers believe that certain crops will thrive only if sowed "in the light of the moon"—the period between the new moon and the full moon. Potatoes, however, will not flourish unless planted "in the dark of the moon"—that is, when it is waning. A few superstitious folk go further and will not butcher meat, gather medicinal herbs, cut their hair, or trim vines except when the moon is "right." Fortunately most farmers today regulate their work by more practical considerations.

Some people still believe that the phases of the moon influence our weather. In Scotland there is a saying, "The bonnie moon is on her back; mend your shoon and sort your thack" (thatch). This refers to the moon that will "hold water." "The old moon in the new moon's arms" was supposed to predict a bad storm, as in the old ballad of 'Sir Patrick Spens'—

I saw the new moon late yestreen.
Wi' the auld moon in her arm;
And I fear, I fear, my master dear,
That we sall come to harm!

When we stop to think about it, we realize that if the phases of the moon determined the weather, astronomers could predict it for thousands of years to come.

Obviously, if the moon is bright and its outline clear, the air is dry; and if it shines with a feeble light, the air is cloudy. "A ring around the moon"—also called a "moon halo"—actually does foretell stormy weather. This appearance is caused by tiny crystals of ice floating in the upper atmosphere, which refract the light of the moon. When the ice crystals make a patch on the side of the moon it is called a "moondog." A moon rainbow, faint and almost colorless, may sometimes be seen when the observer stands between the moon and a shower of rain.

Jack and Jill in the Moon

Instead of "the man in the moon," Swedish peasants see two children carrying a pail of water between them. One of their myths explains how they happen to be there. After drawing water at a well, the children sling the pail over a pole, which they support on their shoulders. Then children, pole, and pail are carried up to the sky, where they may be seen when the moon is full. This is the origin of our nursery rhyme about Jack and Jill, who "went up the hill to fetch a pail of water." In the Swedish story, Jack falls down as the moon wanes to last quarter; and as it continues to shrink, Jill tumbles after him. Of course when the water is spilled it rains—for the Scandinavians too imagined a connection between the phases of the moon and the weather.

MOORS. When the Arab armies swept across northern Africa in the 7th century, they found in the northwestern corner of the continent a white race of ancient origin called the Berbers. These they converted to Mohammedanism after a sharp struggle at the beginning of the 8th century. Then Berbers and Arabs joined in invading and conquering Spain, and a mixed race sprang up called the Moors.

The name Moor comes from the Latin *Mauri*, the name for the Berber inhabitants of the old Roman province of Mauretania, now Morocco. It is applied today chiefly to the people of mixed blood inhabiting the seacoast of the Barbary States. The typical Moors of Morocco are a handsome race, with olive skin, black eyes, and black silky hair. The women are beautiful in early youth, but grow fat rapidly, a quality much admired by their own people. The Moors are courteous and intellectual, but also cruel and revengeful. Of all the pirates who infested the Barbary coast in former days, none was more feared than these mild-mannered cutthroats.

The Moors reached the height of their power in Spain. After the conquest of the Visigoth kingdom in 711, and a period of great disorder, the famous Arab caliphate of Cordova was formed which lasted until 1031. Following the collapse of the caliphate, the Moors (Berber-Arabs) who had obtained control of northwestern Africa crossed to Spain and wrested the power from the pure-blood Arabs.

After the battle of Navas de Tolosa in 1212, in which Alphonso VIII of Castile broke the Moorish power in central Spain, the Moors still ruled the kingdom of Granada, which rose to a splendor rivaling the former caliphate of Cordova. It was not until 1492 that the power of this Moorish kingdom, weakened by internal discord, was shattered by the armies of Ferdinand and Isabella.

The Moors were then expelled from Spain, to the great economic and intellectual loss of that kingdom. A number adopted Christianity and remained in Spain. About 60,000 of their descendants, called Moriscos, dwell in Spain today. Many remains of the days of Moorish greatness are still found in Spain, chief of which is the Alhambra palace at Granada. (*See also* Arabia; Mohammed; Morocco; Spain.)

MOOSE. The largest member of the deer family is the moose. The male or "bull" moose of the common American species stands about six feet high, and may be nine feet long. An average specimen weighs about 900 pounds; a large one reaches 1,400 pounds. Moose are found in the northern United States from Maine to North Dakota and through Canada north to Hudson Bay and northwest past the Arctic Circle.

On the Kenai Peninsula of Alaska lives the largest moose of all—the Alaska moose. It stands about seven feet high and may grow over ten feet long. It weighs from 1,400 to more than 1,800 pounds.

Both the common and the Alaska moose have the same general features and habits. The male has a large head with a broad down-curving muzzle. Beneath his neck hangs a hairy fold of skin called a dewlap or "bell." His magnificent horns or antlers may spread more than six feet. Each antler is like a broad hand with the palm curved and held upward and with the margin branching out into prongs. The antlers are

Here stands a full-grown bull moose, the mightiest of all deer and one of the most powerful of all the wild animals in North America. In autumn the northern forests echo with his hoarse mating call and resound with the clash of his antlers as he fights other bulls that would steal his wives. He squares off with each rival like a boxer and tries to smash him to a sideways position. Then he drives his antlers into his opponent's ribs or flanks. He tears up the ground and breaks down trees in these titanic battles. But most of the year he lives so quietly that his smaller neighbors hardly notice him.

shed in December, sprout again in April, and reach their full size in June.

The female or "cow" moose is about three-fourths as large as the male. She has no horns to offset her huge muzzle and ears, with the result that she is one of the most ungainly and least handsome of all animals. The color of both sexes is black, shading toward brown. The Alaska moose is blacker than the common moose.

In May the cow moose gives birth to one, two, or (rarely) three calves even homelier than herself. Awkward and knob-kneed, they try to follow her wherever she goes. By summer they are already swimming behind her in spring-fed lakes. When tired, they hook their chins or one of their legs over her back and hang on for dear life. Indeed, they like their mother so much that she has to drive them away in spring when she is ready to bear her next pair of twins.

Moose feed on willow tips, on the slender shoots of the maple and other trees, and on bark and various evergreens. They wade along the shores and thrust their heads under water for mouthfuls of tender plants that grow on the bottom. Sometimes when the deer flies are biting, the moose will wade out until only the tips of their noses show above water.

In the mating season, the bull moose crashes through the brush and bellows hoarsely to the cows. But in other seasons, he steals through the forests very quietly despite his huge size. With his long legs, he is a fast runner, and his keen senses of hearing and smell make it difficult for hunters to approach him. Some hunters lure him within rifle shot by imitating the deep braying call of the cow moose. When cornered or wounded, the bull strikes viciously with his front feet as well as with his heavy antlers. (For illustration in color, *see* North America.)

In the northern parts of Scandinavia and Russia lives another and somewhat smaller moose, called the European elk. It is not to be confused with the American elk (*see* Elk).

The extinct Irish elk (*Megaceros hibernicus*) of Europe had mooselike antlers that spread ten feet. But it is believed to have been a species of fallow deer (*see* Deer). Scientific name of common moose, *Alces americana;* Alaska moose, *Alces gigas;* European elk, *Alces alces.*

MORE, SIR THOMAS (1478–1535). "I say no harm, I think no harm; but I wish everybody good," once declared Sir Thomas More, the great English statesman, scholar, and author. This was no idle boast, for the man who made it was a lovable merry man, with warm affections and a kind heart. Among his children he was a loving companion, and often he would take scholars and statesmen into his garden to see his girls' rabbits. And yet this kindly genial man wished it engraved on his monument that as lord chancellor he was "the scourge of thieves, murderers, and heretics." Surely it would be hard to find a character which blends into harmony so many apparent contradictions as Sir Thomas More's.

Son of a prominent London barrister, young Thomas More was reared as a page in the household of Cardinal Morton, who prophesied greatness for his ward. As a student at Oxford, More came under the influence of the New Learning, and later formed a close friendship with the great Dutch scholar Erasmus, who was captivated by his charming personality. These two with John Colet, the distinguished dean of St. Paul's, were the leaders of a group of scholars and religious reformers in England since known as the "Oxford Reformers," who did much to promote the Renaissance in England (*see* Renaissance).

Entering his father's profession of law, More early attained distinction; but for a time religious piety led him to fast, pray, and scourge himself as a preliminary to entering the priesthood. He finally gave up this plan, but the religious motive remained supreme in his life, and every Friday he scourged his body as penance for sin.

His Dispute with the Throne

In 1504 More gained the enmity of Henry VII by opposing, as a member of Parliament, the king's exorbitant demands for money aids. The accession of Henry VIII brought More, almost against his will, into high place at court. The young king was attracted by the rising lawyer's learning, wit, and geniality, and employed him on various embassies. He knighted him, promoted him through various official posts, and on Cardinal Wolsey's fall from power, in 1529, More was made chancellor—the first time that the office had been held by a layman. More, like Erasmus, wished for an orderly reform of acknowledged abuses in the church, but he did not hesitate to burn as heretics persons who were infected with Protestant heresies from Germany. When it appeared that Henry had resolved on a divorce from his queen, Catherine of Aragon, More as a loyal churchman resigned his office on the plea of ill health. He refused to acknowledge Henry's claim to be head of the English church, and for this defiance the king had More—together with Bishop Fisher and others—committed to the Tower on a charge of treason. Against the pleadings of his favorite daughter, Margaret Roper, his wife, and his friends, More stood firm, and on July 6, 1535, he was beheaded on Tower Hill. This was made his festival day when he was canonized by Pope Pius XI 400 years later.

Even in his death More's wit did not desert him. Climbing the scaffold where he was to die, he said to the officer in charge: "I pray you see me safe up; as for my coming down, let me shift for myself." When the ax was about to fall he asked the executioner to wait a minute until he had removed his beard, observing, "Pity that should be cut, which has never committed treason."

More's fame is not merely as a statesman and religious martyr, but as the author of 'Utopia', a romance written in Latin in 1516, and translated into English in 1551. 'Utopia' (which means "nowhere") is the name of an imaginary island which More represents as the abode of a happy society, free from all cares, anxieties, and miseries. All men are equal, and everyone may worship as he chooses. None is allowed to become rich through the oppression of others; property is held in common, and all are

SIR THOMAS MORE IN THE TOWER OF LONDON

Here are Sir Thomas and his daughter, gazing out the window upon four monks being led to execution, during the stormy times when Henry VIII broke with the church of Rome. Sir Thomas, formerly chancellor of the kingdom, had been imprisoned charged with treason when he opposed Henry's move. His family urged him to acknowledge Henry's supremacy, but he stood fast, and eventually died upon the scaffold. On the occasion which this picture illustrates, he characterized the monks as "blessed fathers who were going as cheerfully to their deaths as bridegrooms to their marriage," and it was in this spirit that he met his own fate.

required to perform the same amount of labor. The book had a political object, for the evils which it depicts as remedied in Utopia are those which then bitterly afflicted England. From the title of this book we get the adjective "utopian," which is applied to plans for the improvement of society that are considered visionary and impracticable.

Mormons, or Latter-day Saints. The term "Mormons" is really a nickname for members of The Church of Jesus Christ of Latter-day Saints, and also of the Reorganized Church of the same name.

Joseph Smith (1805-1844), founder of Mormonism, received his first heavenly manifestation, it is said, at the age of 14. Other visions followed, including those which revealed to him the Book of Mormon, which purports to be a record of the early inhabitants of America—three groups of people, one of whom had come from Babylon at the time of the confusion of tongues, and the other two from Jerusalem about 600 B.C. He organized the Church of Jesus Christ of Latter-day Saints with six members at Fayette, N. Y., April 6, 1830. Missionaries were sent out and branches were started in various states and in Europe. Headquarters were established at Kirtland, Ohio, Independence, Mo., and at Nauvoo, Ill. Following trouble with non-Mormons, the Mormon leaders were thrown into jail at Carthage, Ill. On June 27, 1844, a mob stormed the jail and killed Joseph Smith and his brother, Hyrum.

The Mormons then decided to go to the Far West. On their thousand-mile trek to the valley of the Great Salt Lake, one of the notable migrations in history, they were led by Brigham Young (1801–1877). They arrived in July 1847. This first band of Mormon pioneers consisted of 143 men, 3 women, and 2 children.

The Mormon church has a well-defined doctrine and plan of church government. It believes in a personal God who can and does reveal himself in these days as in Biblical times. It claims to enjoy the power of his priesthood by virtue of which its officers preside and function. It has an organization through which the greatest possible number of its members can be given actual responsibility. The local unit is the ward, presided over by a bishop and his two counselors. The thousand wards are grouped into a hundred "stakes," each of which is presided over by a stake president and two counselors. The general authorities who preside over the church as a whole consist of the president with two counselors, the quorum of the 12 apostles, the 7 presidents of 70, the presiding patriarch and the presiding bishopric.

It operates a missionary system under which 2,000 young men and women at their own expense regularly carry its message to the world. There are missions throughout the United States, New Zealand, Europe, South Africa, Australia, Canada, Mexico, South America, Hawaii, and other islands of the Pacific.

Through its various organizations, the Mormon church enters into almost every phase of the life of its people. It maintains schools and seminaries. Its Primary Association provides training for children between the ages of four and twelve. Through its Mutual Improvement Associations young people study religious, scientific, and literary topics. The Relief Society and the Welfare Program take care of people in sickness and want. Through investments in numerous industrial and commercial enterprises the church has also become closely linked with the economic life of its members.

The church is financed through a system of tithing. Under this system, members usually contribute one tenth of their annual income toward the support of the church and its works.

Because polygamy was once practised among a small percentage of its members, the church was severely criticized. In 1890 Wilford Woodruff, then president, ordered members to "refrain from contracting any marriages forbidden by the laws of the land." Since then the policy of the church has been definitely against plural marriages.

The Church of Jesus Christ of Latter-day Saints has about 1,040,000 members in the United States and thousands abroad. Its headquarters, with the famous temple and tabernacle, are in Salt Lake City. (*See* Salt Lake City; Utah.)

The Reorganized Church

The Reorganized Church of Jesus Christ of Latter-day Saints was set up in Wisconsin in 1852 by a group that repudiated Brigham Young's leadership. Joseph Smith, son of the founder of Mormonism, was president from 1860 to 1914. His son Frederick M. Smith succeeded him. The organization and government of the Reorganized Church are similar to those of the Utah Mormons. It also has its own schools, hospitals, and missions. Members hold that the doctrine of plural marriages was not taught by Joseph Smith, the founder, or sanctioned by the original church. There are about 140,000 members in the United States and in branches in other countries. Its headquarters are in Independence, Mo.

MORNING-GLORY. On clear summer days the morning-glories open their blossoms early. The bright blossoms look like colorful little funnels. They are fragile, and each blossom lives only a day; but the plant needs little care and grows almost everywhere. The wild morning-glories are also called bindweed or glorybind. They twist among wayside shrubbery. The cultivated morning-glory climbs garden walls.

The common morning-glory is one of the cultivated species. It has purple, blue, or pink flowers about three inches long, sometimes double. Its five-inch leaves, broad and heart-shaped, grow from a trailing stem four to ten feet long. It has many close relatives, including the sweet potato. Different species grow widely throughout the tropical and temperate regions of the world.

Morning-glories are remarkable for their trailing or twining habit of growth. Some are annuals and some are perennials. They will flourish in any good soil but prefer a sunny spot. Because of their rapid growth and their profusion of leaves and blossoms, gardeners plant them to hide fences, verandas, and to screen unsightly objects. (For illustration in color of wild morning-glory, *see* Flowers.)

Scientific name of common morning-glory, *Ipomoea purpurea*, annual; sweet potato, *Ipomoea batatas*, perennial; wild morning-glory, *Convolvulus sepium*, perennial.

MOROC'CO. For many centuries the northwest corner of Africa, adjoining the Strait of Gibraltar between the Atlantic and the Mediterranean, belonged to Morocco. This strategic location and Morocco's weakness led several European nations to covet the land; but they blocked each other for many years.

In 1912, however, the rival countries agreed to let Spain have a small strip along the Mediterranean and to let France establish a protectorate over the remainder. The city of Tangier on the strait was made an international zone (*see* Tangier).

The Spanish Protectorate of Morocco

Spanish Morocco extends 200 miles along the Mediterranean and 50 miles down the Atlantic coast. It covers an area of about 10,800 square miles and has a total population of 1,192,000 (1950 est.): northern zone, 1,180,000; southern zone, 12,000. Almost the entire area is covered by the Riff Mountains. Natives are mainly Berbers and Arabs.

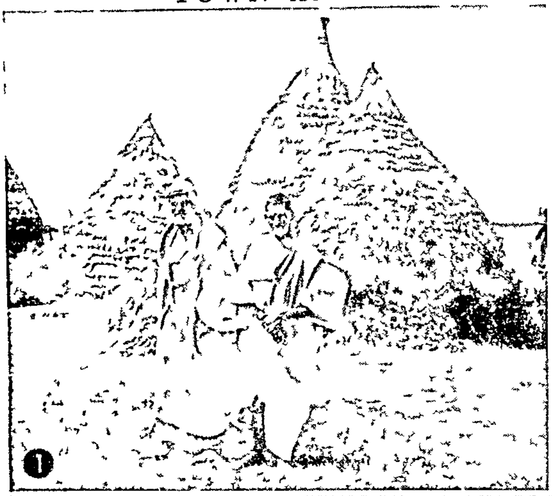
In the highlands the people tend goats and sheep and gather cork from the forests. On the coastal plain they raise grains, beans, olives, and fruits. The capital and largest city, Tetuán, produces tiles, pottery, and Morocco leather. Melilla, in the east, and Ceuta, opposite Gibraltar, serve as ports for Spanish Morocco but do not belong to it. These ports are governed as presidios of Spain.

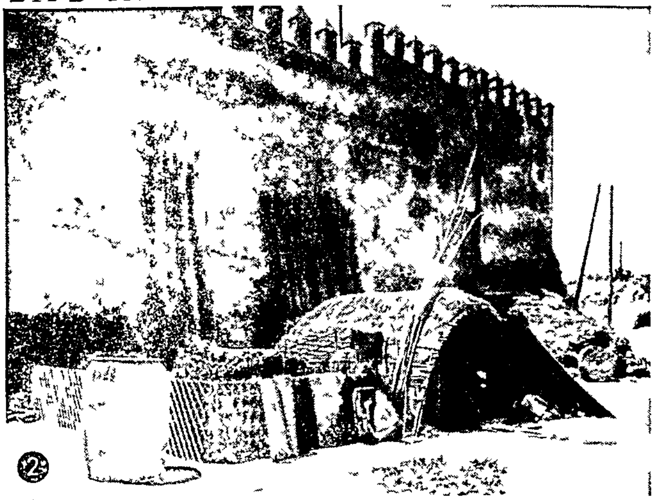
The French Protectorate of Morocco

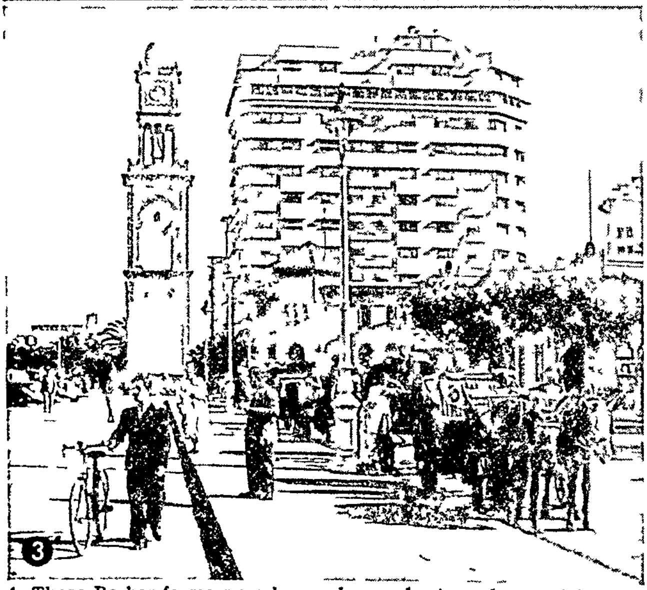
French Morocco, only a small foothold on the Mediterranean, extends 600 miles down the Atlantic. Its area, almost the size of California, is 153,910 square miles, and it has a population of 8,003,985 (1951–52 census). From the southwest to the northeast the Atlas Mountains sweep across the country. The central range, the Great Atlas, reaches an average height of 11,000 feet. South of the mountains the Sahara begins; to the north, plains open westward to the Atlantic. The northern slopes are well watered and have dense forests. In summer the plains are hot and almost rainless. In many valleys, however, streams fed by mountains are used for irrigation.

French Morocco is governed by a cabinet presided over by the grand vizier of the sultan of Morocco. Natives and French compose the cabinet. The native Berbers and Arabs are Mohammedans and most are illiterate. The Berbers, energetic workers, farm the plateaus. The Arabs pasture sheep and goats in the mountains and share with the French the fertile lowlands. The chief crops are barley and wheat, beans, almonds, lemons and oranges, olives, dates, figs, and grapes. Atlantic fisheries furnish tunny and anchovies; from the forests are obtained cork and ce-

TOWN AND COUNTRY LIFE IN FRENCH MOROCCO







1 These Berber farmers work on a large wheat ranch owned by the French. Since their village is miles away, they have put up summer lodgings in the fields. 2 A basket weaver has built his home and set up shop outside the wall of Fez. 3 A modern apartment house and a Moorish clock tower mark this corner of the Place de France, the center of Casablanca. 4 The weavers' quarter in Meknes. Boys stand in the street, holding woolen threads taut for the carpet weavers, who sit indoors.

dar wood. Rich mineral resources, developed by the French, yield phosphate, zinc and lead, manganese, and molybdenum. Some iron, tin, antimony, and coal are also mined.

The French transformed Casablanca on the Atlantic from an insignificant Arab town into a white and shining city, one of the chief ports of North Africa. Most of the European population lives here or in the capital, Rabat. The largest inland city is Marrakesh, an ancient Arab trade center at the foot of the Atlas Mountains. In Fez native workmen make the round felt caps named for the city and decorate soft Morocco leather in exquisite Moorish designs. The university at Fez, once a famous seat of Mohammedan learning, still ranks high in the Islamic world.

How the French Gained Control

In ancient times Morocco was known as Mauritania. The original Berber inhabitants were subject first to Carthage and then to Rome. In 429 the Vandals overran the country, bringing in piratical customs that were to give the Barbary (Berber) coast an evil name. In 682 the Arabs appeared and converted the natives to Mohammedanism. Together they conquered Spain, where they were called "Moors" because they came from Mauritania (*see* Moors; Mohammed). Morocco flourished as a center of Moorish learning and industry. For 1,200 years it retained its independence.

The sultan's government eventually became lax and corrupt. Banditry came to a climax in 1904 when the notorious Raisuli captured a naturalized American citizen, Ion Perdicaris, and held him for $70,000 ransom. The United States demanded "Perdicaris alive or Raisuli dead." The sultan paid the ransom, but appointed Raisuli governor of Tangier.

France claimed that this anarchic condition menaced its adjoining territory of Algeria, and wanted

to intervene. It reached an agreement with England and won the support of Spain by recognizing a Spanish zone of influence. But in 1905 the German Kaiser appeared at Tangier and announced that German interests would have to be considered. War threatened, but was averted by a conference at Algeciras, Spain, in 1906. This upheld the position of France. In 1911 Germany again brought Europe to the verge of war by sending a gunboat to Agadir; and again England supported France. In 1912 Germany recognized the French protectorate in return for grants of French territory in west Africa.

After the first World War the French governor of Morocco, Marshal Lyautey, subdued the native chiefs and helped Spain to put down the Riffians under Abd el Krim. The French introduced modern agricultural methods, developed mines, built highways, and erected modern buildings outside the old Moorish cities.

In the second World War American forces landed in Morocco in 1942. After the war nationalism increased and Moroccans rioted against France in 1952–54. Meanwhile France had granted Moroccan air bases to the United States. (*See also* Tangier.)

MORRIS, ROBERT (1734–1806). Robert Morris is known in American history as "the financier of the Revolution." He earned this distinction by his success in raising money to support Washington's army. He even borrowed on his own credit as a wealthy businessman to purchase supplies.

Morris was born in Liverpool, England. When he was 14, he joined his father in Maryland. At 20 he was made a partner in a large banking and importing firm in Philadelphia.

In 1765 he joined in the opposition to the Stamp Act and he became a strong supporter of the colonial cause. In 1775 he was elected a member of the Second Continental Congress. He voted against the Declaration of Independence because he considered that "it was an improper time"; but when the Declaration was adopted he signed it. From 1776 to 1778 he was a member of the finance committee of Congress. Twice thereafter he managed the finances of the country. From 1781 to 1784 he was superintendent of finance.

In 1782 he opened the Bank of North America in Philadelphia. This was the first financial institution chartered by the United States. In 1787 he became a member of the constitutional convention in Philadelphia. Washington offered him the post of secretary of the treasury; but Morris refused it, recommending Alexander Hamilton instead.

Later Morris fell heavily in debt as a result of land speculation. In 1798 he was confined in a debtor's prison in Philadelphia. He was released in 1801, following the passage of the Bankruptcy Act of 1800, which forbade imprisonment for debt. Broken in health and in spirit, he died five years later.

MORRIS, WILLIAM (1834–1896). "A man should put his heart into his work, and that work should be the kind that he can care about." This was the creed of William Morris, English poet and artist, and a practical dreamer of extraordinary energy and versatility.

Young Morris was remembered by schoolfellows at Marlborough as "a thick-set strong-looking boy, with a high color and black curly hair, good natured and kind, but with a fearful temper." He was fond of doing things with his hands, of taking solitary strolls. and of telling stories "full of knights and fairies." At Oxford Morris began a lifelong friendship with the artist Edward Burne-Jones. After leaving Oxford, they both came under the influence of Dante Gabriel Rossetti, the poet-painter, and joined his group of Pre-Raphaelites.

The Pre-Raphaelites were a small group of poets and artists who disliked the conventional art of the day, and sought inspiration in the simple religious art which preceded Raphael. Both in painting and in literature they strove for quaint simplicity and an odd realistic way of treating old medieval themes. Their colorful paintings show mysterious damsels, tall and willowy, who wander through gardens of lilies, sunflowers, or apple blossoms, clad in white and scarlet.

In 1859 Morris married Jane Burden, a noted beauty whom he had often painted. Up to this time he had worked at poetry, painting, and architecture. Now he began a new career as a decorator. He disliked furnishing his home with the fashionable, overtrimmed furniture of the day, and decided to design and make his own. In 1861 Morris, Burne-Jones, Rossetti, and others started a business in London, making unusual household furniture such as Morris chairs. They also made curtains, rugs, tapestries, wallpapers, and even stained glass. Morris threw himself heart and soul into this work, seeking to refine popular taste and stimulate a love of the beautiful in common things.

Later at his famous Kelmscott Press at Hammersmith Morris turned out beautifully printed and illuminated books. Among these were a number of his own, for all his life Morris wrote fluent and often beautiful poetry and prose. In his later years he became an active Socialist and taught that work which brought no joy was fit only for slaves. When he died, his body was taken to the little Kelmscott churchyard in a haycart decked with vines and bulrushes.

Among Morris' works are: 'The Defence of Guenevere' (1858), a book of picturesque ballads; 'The Life and Death of Jason' (1867), and 'The Earthly Paradise' (1868–70), dreamy romantic narrative poems on classic and medieval themes; 'Sigurd the Volsung' (1876), an almost epic poem taken from Icelandic sources; 'Love Is Enough' (1872), a mystery play; 'The Well at the World's End' (1896), one of a series of remarkable prose romances; and 'News from Nowhere' (1890), a romantic pastoral that describes an England in which Socialism had been realized.

MORSE, SAMUEL F. B. (1791–1872). "I wish that in one instant I could tell you of my safe arrival, but we are 3,000 miles apart and must wait four long weeks to hear from each other."

Samuel Finley Morse, a 20-year-old, homesick boy, wrote this sentence in a letter to his mother in 1811. She was in the house in Charlestown, Mass., where he had been born, and he had gone to London to study art. Perhaps it was at the moment of writing that letter that young Morse first conceived the desire

to bridge space with flying words—a desire which was later to give the world the electric telegraph.

His life was one long record of courage, integrity, patience, and faith, of poverty and struggle nobly endured in the pursuit of worthy ends. His father was a noted Congregational minister of Charlestown, a man of high education who counted among his friends no less a person than General Washington. Young Morse was educated at Phillips Academy and Yale. Courteous, studious, with his father's dignity and his mother's gracious manner, he commended himself to teachers and students alike. He showed a deep interest in chemistry and physics, especially in electromagnetism; but art was his chief concern.

It was a keen disappointment to his father when his eldest son chose to be an artist, for art in New England was looked upon at that time as a frivolous pursuit. Long years of struggle followed, but recognition came at last, and at the age of 40 Samuel F. B. Morse occupied a high place in his profession in the United States.

Love for Science Triumphs

But all this time his love for science was struggling in the back of his mind. When in 1832 he was returning from Europe in the steamship *Sully* there happened to be several men who were interested in electricity. During a discussion one day Morse suddenly suggested: "If the presence of electricity can be made visible in any part of the circuit, I see no reason why intelligence may not be transmitted by electricity." As he sat on deck, he worked out his plan in a series of drawings and explained them to his fellow-passengers. With a few minor changes, the instruments he devised that day became the models for the ones he later patented and which are now in use the world over.

Morse arrived in New York, a successful artist, with commissions awaiting him, and a life of ease, honor, and wealth before him. But he chose to disappear into a little shop in New Haven, and live long years of poverty, obscurity, toil, and ridicule in pursuit of his scientific vision. He lived alone in his shop, sleeping on a cot, cooking his own food, often going hungry. In 1837 he applied for a patent on "The American Electromagnetic Telegraph," but the "wild scheme" was thought impractical by capitalists and business men.

Recognition Comes Slowly

He went to England, France, and Russia seeking aid for his invention, but failure met him at every step. After superhuman efforts he eventually induced the United States Congress in 1843 to appropriate $30,000 to build a line from Washington to Baltimore. In May 1844, the first message was flashed over this wire. The text of this epoch-making message was: "What hath God wrought?" (*See* Telegraph.)

The inventor's labor of years was crowned with success. He was then 53 years of age. Seven years later the Western Union Telegraph Company was organized, and St. Louis was connected with Buffalo by wire. From that time on the growth of the electric telegraph was rapid. Although other men of science, both before and after 1837, in Europe as well as America, worked at the problem, Morse's system is the basis of most land telegraph systems to the present day. The code of dots and dashes now generally used is still known as the "Morse code" in honor of its inventor. From 1857 to 1858 he was the electrician for Cyrus W. Field's Company which with the help of English capital was making the first attempt to lay a cable across the Atlantic (*see* Cables).

As the inventor's fortune increased, he built a villa at Locust Grove on the Hudson. He surrounded himself with books and pictures and extensive gardens and his home became famous for its gatherings of distinguished men and women. His death in 1872 was an occasion for national mourning.

MOSAIC (*mō-zā'ĭk*). Nothing shows better how men love the beautiful than their efforts to make the floors, ceilings, and walls of their homes and temples, even the pavements, artistic. This may be seen best in mosaic work, which consists of designs in colored stones or glass made by the use of small pieces fitted together and held in place by cement. The pattern or picture becomes thus practically indestructible. This art was known to the Assyrians and Egyptians and flourished during the palmy days of Rome. It was revived later, especially for churches; and came into great popularity again in Italy during the middle of the 13th century.

There has been a revival in modern times and the demand for mosaic is steadily increasing. Italy still produces some of the most beautiful mosaics, but American artists and studios have achieved distinction, and some of the finest designs ever produced are to be found in American buildings.

Florentine mosaic, used chiefly for jewelry, personal ornaments, and paper-weights, is composed of shells or stones of natural colors cut in much larger pieces than are employed in Roman mosaics.

Tessellated mosaics, used chiefly in floors such as the famous one uncovered at Pompeii, are made of small cubes of marble, glass, or terra cotta nicely fitted together.

MOSCOW (*mŏs'kō*). In the heart of European Russia lies Moscow, or Moskva, the capital and largest city of the U.S.S.R. Around this city as a nucleus the czars had gathered together the old Russian empire. Today from Moscow's ancient Kremlin the Soviet government reaches out to direct the affairs of its vast dominions.

In the 12th century a Russian prince built a strong fortress (*kremlin*) on the little Moscow River. This stream flows into the Oka, a chief tributary of the Volga. Then, as now, the Volga was the great highway of Russian life. Soon a little village, taking its name from the river, grew up around the fortress, supplying the needs of travelers. The surrounding territory became the principality of Moscow, sometimes called Muscovy. In the 13th century the Tatars over-

ARMS FLASH IN MOSCOW'S RED SQUARE ON MAY DAY

Organized throngs take over Red Square in Moscow on May Day. In Soviet Russia May Day is the greatest of all propaganda events. It is the national holiday when the Communists order the workers to "celebrate" the "freedom and gains of the working people." Managers of factories, shops, and offices organize parade units. But the grim high light of the parade is the Red army's display of disciplined troops, planes, and massed armor. Officials review from the red granite tomb of Lenin, at right center in this photograph. Behind the tomb is the brooding, walled Kremlin. At the end of the square looms the Church of St. Basil the Blessed, multicolored and gilded, with bulbous Byzantine domes. It has been changed from a church into a museum. The tower at the right rises over Spasskiye Gate, which was built in 1491 as the main entrance to the Kremlin. Note the Red Star atop the tower. The clock's chimes play 'Internationale'. Red Square was once a place of executions. Later it became a market center of the Tatars, then a bazaar for czarist Russia.

ran Russia, making their headquarters in the Volga valley. The Muscovites traded with the Tatars and prospered. Sailing down the river in their small craft, they went as far as the Caspian Sea and even to Persia (now Iran) and India with their furs, leather, wax, and honey.

The Kremlin, a triangular area of about 60 acres, was enclosed by wooden walls. Within it stood the palaces of the prince and the nobles, churches, monasteries, and convents. In the 14th century the prince of Muscovy built there the Cathedral of the Assumption, and persuaded the head of the Russian Orthodox Church to make the Kremlin his headquarters. From that time on Moscow became "Holy Mother Moscow" to the Russians, and its princes came to be looked to as the leaders of all the Russian people. Spreading its rule over other principalities, powerful Moscow gradually "gathered all Russias together" and broke the grip of the Tatars (*see* Russia, section on history).

In the 15th century Ivan the Great, Grand Duke of Muscovy, called in Italian architects to embellish the Kremlin. They rebuilt in stone the Cathedral of the Assumption (in which all the czars were to be crowned) and replaced the wooden stockade with a wall of pink brick, 12 feet thick, 65 feet high, and spaced with towers. In the 16th century Ivan the Terrible had Russian artisans "who were wise and facile in such wondrous work" build outside the Kremlin walls the fantastically beautiful Church of St. Basil the Blessed. Legend says that Ivan put out the architect's eyes so he could never again build anything like it.

Red Square Becomes a Busy Trade Mart

Adjoining the Kremlin the Tatars had built their own fortress, the Kitai Gorod, surrounded by a wall of Chinese brick. Here they lived and traded. The Muscovites set up their market in a great open space called the Red Square. All day long they thronged the muddy passages between their tents and stalls, haggling loudly over their wares—horses and carriages, jewelry from India, silks from China, fish from the Volga, furs from Russian forests, and grain from Russian farms. Here in Red Square the czar's heralds announced important events—births, marriages, or wars. Here, under the frowning Kremlin wall, criminals, political offenders, and sometimes whole regiments of soldiery were beheaded. And here riots frequently broke out and were ruthlessly put down by the czar's cavalry, the dreaded Cossacks.

Built almost entirely of wood, Moscow was many times destroyed by fire, and its population was repeatedly cut down by famine and plague. After each disaster it rose greater than before. Mud walls circling the city had to be rebuilt five times, each time farther out. (Later they were leveled and turned into boulevards, giving Moscow the appearance from the air of a bull's eye target.) By the 16th century Moscow was the greatest trading center of eastern Europe.

In 1703 Peter the Great, despairing of converting the semi-Oriental Muscovites to Western ways, moved out and founded a new capital at St. Petersburg (now Leningrad). Moscow then declined. In 1812 Napoleon's army entered the city, only to find it in flames (*see* Napoleon). But again Moscow rose from its ashes. At the end of the 19th century it entered upon a new career as a great industrial city. Railroads radiated from it in all directions. Stone mansions and public buildings in the Russian "Empire" style spread over the heart of the city. Even as late as 1917, however, two-thirds of the houses were still of wood, most of them only one story high.

The Bolsheviks Move into the Kremlin

Red Square again saw bloody fighting in the "October Revolution" of 1917. In 1918 the new Communist government, fearing foreign invasion, fled from St. Petersburg and established itself behind the carefully guarded walls of Moscow's Kremlin. By 1920 hardship and famine had caused such an exodus from the city that its population dropped from 2,000,000 to 800,000. In 1922, when the Union of Soviet Socialist Republics was organized, Moscow was made the capital of the Union and also of its largest republic, the Russian Federated Socialist Republic.

In 1928 the Soviet government launched its great program of industrialization. Peasants swarmed into Moscow to work in the new factories. Wooden houses were torn down to make room for square blocks of apartments. But new buildings did not keep pace with the swelling population and "one room to a family" became the rule. Government offices overflowed the Kremlin and huge new buildings were put up outside its walls to house the growing bureaucracy. A subway was constructed with underground stations of polished marble and granite. Cobblestone streets were paved with asphalt. On Gorki Street—Moscow's smartest thoroughfare—buildings were pushed back, widening the street from 50 to 150 feet. The remaining walls of the Kitai Gorod were leveled and some of Moscow's "forty-times-forty" churches were crowded out, but many of the beautiful relics of the past were preserved. The Church of St. Basil the Blessed, converted into a museum, now looked across Red Square toward Lenin's tomb, severely modern in cubes of red granite.

New Growth of the City

Giant glass-walled factories and block tenements spread over new suburbs. Moscow's workers began to manufacture steel, machine tools, locomotives, automobiles, precision instruments, textiles, and clothing. In 1937 the Moscow-Volga Canal was completed, linking the Moscow River with the headwaters of the Volga, 74 miles to the north. This provided the city with an ample water supply and gave it access to the Baltic Sea through rivers and canals.

"Holy Mother Moscow" became the center of Communist culture and propaganda. The Moscow State University, the oldest in Russia, and the Academy of Sciences, founded by the czars, spread the teachings of the Soviet doctrine. Moscow's publishing houses put out books in a hundred languages for the many peoples of the U.S.S.R. Schools, theaters, museums, libraries, and workers' clubs grew (*see* Russia).

Ruin again threatened Moscow when the German armies drove toward it in 1941 in the second World

War. Its bitter winter weather helped the Russians to defend it successfully, and it suffered little from bombing. After the war Moscow's population swelled so much that housing became an acute problem. Instead of building the vaunted Palace of Soviets, the government erected a 26-story Palace of Science for Moscow University, several skyscraper office buildings, and giant apartment blocks; but housing remained cramped. Population (1947 est.), 4,500,000.

MICHELANGELO'S 'MOSES'

This majestic head is from the full figure of 'Moses' (*see* Michelangelo). The "horns" represent the light that shone from Moses as he came down from Sinai.

MOSES. The mightiest prophet, leader, and lawgiver of the Jewish people was Moses. As recorded in the Bible he saw God face to face; he led the Jews from bondage in Egypt to freedom in the Promised Land; and from God he received the Ten Commandments for his people. Moses set forth the laws which became the foundation for the Jewish religion. Many of these laws are also part of Christian doctrine. The Moslems regard Moses himself as one of their prophets (*see* Mohammed).

All that we know of Moses directly comes from the Bible, mainly from Exodus, Leviticus, Numbers, and Deuteronomy. These, with Genesis, make up the Pentateuch (Greek for "five books") portion of the Old Testament. They are sometimes called the Five Books of Moses because he is traditionally regarded as the author. Scattered references to Moses may be found throughout the remainder of the Old Testament and in the New Testament as well.

Ancient Egyptian records show that the Exodus of the Jews from Egypt took place under the reign of the Pharaoh Mer-ne-Ptah, who ruled from 1232 to 1222 B.C. Thus Moses was born in the reign of Mer-ne-Ptah's predecessor, Rameses II (1298–1232 B.C.). Though born a Jew, Moses was adopted by Rameses' sister and reared as an Egyptian prince. His heart was with his people, however, and when he saw an Egyptian overseer beating a Hebrew slave he killed the bully. For this Rameses ordered Moses slain. Moses escaped and fled to the land of Midian. There he married Zipporah, daughter of Jethro, a Midianite priest. They had two sons, Gershom and Eliezer.

While tending Jethro's sheep in the wilderness near Mount Sinai, Moses saw a bush which continued to burn but was not consumed. From it came God's voice bidding Moses to lead the Jews out of Egypt and into Canaan (Palestine), the Promised Land. Moses felt himself unworthy of this great mission, but God showed him His power and promised to help him. With his brother, Aaron, Moses forced the Pharaoh to release the Jews. He created a series of plagues, each more terrible than the last, and finally the Jews were allowed to depart (*see* Passover).

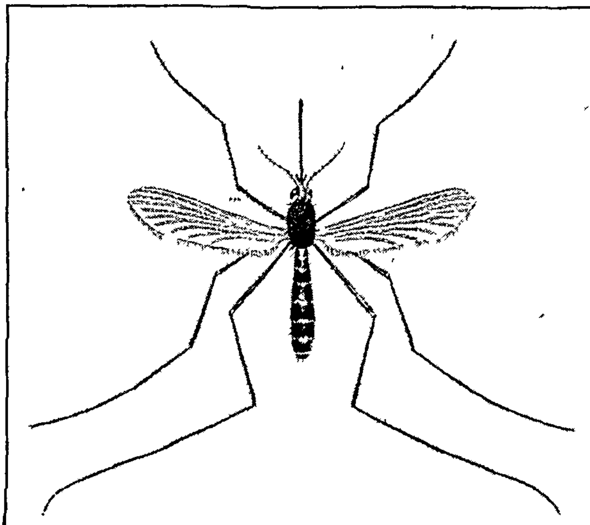
Egyptian soldiers pursued them to the shores of the Red Sea. Winds divided the waters and the Jews passed safely across, but the pursuing horsemen and charioteers were drowned. In the desert wilderness God provided water to drink and manna to eat. Moses ascended Mount Sinai, and there the Lord gave him the Ten Commandments, engraved on tablets of stone. The commandments are recorded in full in Exodus, chapter xx, verses 2 to 7, and in Deuteronomy, v, 6 to 21, in the King James version of the Bible. (The Catholic, or Douai, version differs slightly.) In brief form they are:

1. I am the Lord thy God . . . Thou shalt have no other gods before me.
2. Thou shalt not make unto thee any graven image, or any likeness . . .
3. Thou shalt not take the name of the Lord thy God in vain . . .
4. Remember the sabbath day, to keep it holy . . .
5. Honour thy father and thy mother . . .
6. Thou shalt not kill.
7. Thou shalt not commit adultery.
8. Thou shalt not steal.
9. Thou shalt not bear false witness . . .
10. Thou shalt not covet . . .

While Moses was on the mountain, his people built a golden calf to worship. Seeing this idolatry upon his return, Moses smashed the tablets of the law in his rage. He destroyed the idol; then in a spirit of compassion he begged the Lord to forgive the Jews for their sin. The Lord did so and gave Moses a second set of tablets.

For 40 years Moses led the Jews through the desert. A new generation grew up, one which was able to forget that their fathers had been slaves. They were proud, strong, and secure in their faith. Moses led his people up the east bank of the Jordan River, opposite Jericho. There he appointed Joshua as the new leader who would take them across the river into Canaan. Then Moses climbed Mount Nebo, where God showed him the Promised Land beyond the river. Moses' task was done; and now at the age of 120 years he was ready for death. The Lord buried him in Moab, "*but no man knoweth of his sepulchre . . .*" (*See also* Bible; Bible Lands; Jews.)

The MOSQUITO—*Always a* PEST, *Often a* KILLER



A female mosquito of the species *Culex pipiens*, four times enlarged. This is the common house mosquito of the northern states.

MOSQUITO. To most of us, mosquitoes are just annoying. But throughout the ages some of these little insects have been deadly enemies of mankind, spreading malaria, yellow fever, and other diseases.

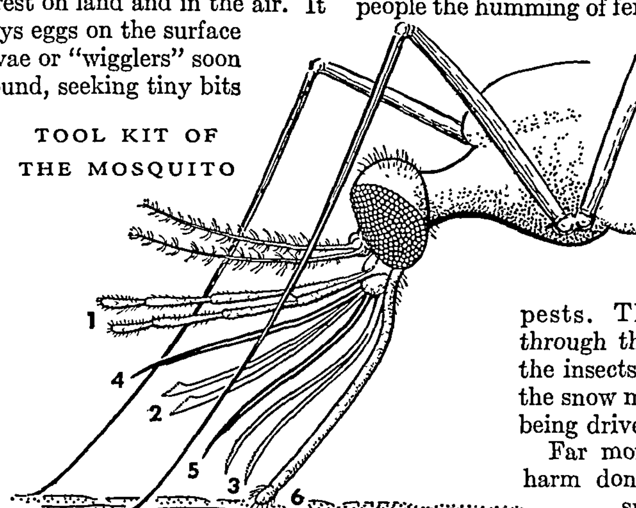
Certain scholars believe that malaria, by sapping the strength of the people, started the downfall of the ancient Greek and Roman civilizations. We know that it took heavy toll among pioneer Americans and continues to afflict millions of people in hot damp countries. Yellow fever, born in the mosquito swamps of tropical coasts, held back the colonization and development of new lands, and spread death even into temperate regions.

Until the beginning of the 20th century, however, the mosquito's deadly rôle was not recognized. The detective work that exposed its responsibility and made possible a successful fight against these diseases was one of the great chapters in the history of science. Americans can be proud of this achievement, because their army led in the attack and won the fight.

This thrilling story can best begin with the mosquito itself, how it lives and how it spreads disease.

Life of the Mosquito

The mosquito leads an *amphibious life*, the first part spent in water and the rest on land and in the air. It begins when a female lays eggs on the surface of stagnant water. Larvae or "wigglers" soon hatch out and swim around, seeking tiny bits of food. Those of most species must come to the surface for air. Soon they change into pupae, or "tumblers"; and presently each pupa becomes a grown insect and flies away.



The parts of her slender beak are spread out here for identification. They are numbered in order of use: 1, the *palpi* that find the exact place to bite; 2 and 3, the saws that cut an opening in the skin; 4, the tube that injects saliva into the wound; 5, the tube that draws out the blood; and 6, the sheath in which saws and tubes are enclosed when not in use.

Development from new egg to adult may take as little as 9 to 14 days, depending upon the species. Dry or cool weather tends to prolong the period. Through cold winters eggs lie dormant; so do the fertile females of some species. The active life of a female may last from ten days to a month or more, during which time she will lay several batches of from 50 to 200 eggs.

The mouth parts of the mosquito are exquisitely designed for sucking juices. To the eye, its "beak" looks like a single thin tube. Actually it consists of a sheath, enclosing saw-tipped daggers, an injection tube, and a sucking tube. These parts are not fully developed in the male mosquito, which feeds only on plant juices. The female is the one that bites, and though she can live on plant juices, she greatly prefers blood. To get it, she settles upon a victim, selects a likely spot, and starts sawing through the skin. Into the puncture she then injects a bit of saliva. This keeps the blood from coagulating. Lastly, she sucks up a meal of the prepared blood and flies away. The itching of a mosquito bite is caused chiefly by the injected blood solvent. It will be worse, therefore, if the insect is driven off or killed before it has time to suck back the irritating liquid.

Mosquito bites and the later itching can be bad enough to destroy all pleasure in being out of doors. People tend to shun mosquito-infested places. This fact delays the development of many areas. To many people the humming of female mosquitoes is as annoying as their bite. This "song" is a signal to attract males and varies with different species.

In the far northern regions of Canada, Alaska, and Siberia, mosquitoes attain their highest peak as pests. There mosquito eggs live through the winter in the snow, and the insects hatch out in swarms when the snow melts. Tales are told of men being driven insane by them.

Far more serious, however, is the harm done by the mosquitoes that spread diseases. This is accomplished by biting well persons after having bitten sick ones. The germs or virus of the diseases in ques-

tion are drawn in with the blood of the sick and later the germs are injected with the mosquito's saliva into the new victim. It must be said that the mosquitoes gain no advantage whatever from this deadly traffic. They are merely used by the germs as a sort of halfway house.

How Mosquitoes Spread Yellow Fever

The details of the transfer are relatively simple in the case of yellow fever. This disease is caused by a virus in the blood of men and animals which seems to undergo little change in the body of the mosquito. The species of mosquito chiefly responsible for carrying the disease from one human being to another is *Aëdes aegypti* (formerly called *Stegomyia fasciata*). But other species are known to transmit the virus, and when a mosquito has bitten an infected man or animal, its bite remains infectious throughout its life. Among the jungle animals of tropical America found to be susceptible to yellow fever are monkeys, opossums, ant-eaters, sloths, armadillos, and several kinds of rodents. It appears among them usually in very mild form, but when mosquitoes transmit their virus to human beings the effects can be just as disastrous as when they transmit it from man to man.

Yellow fever attacks the liver, kidneys, and digestive tract, producing intense fever and jaundice. The resulting yellow color of the skin gives the disease its name. Within a few days, from 50 to 90 per cent of the victims die. Those who recover are thereafter immune. Children are more likely than adults to survive the disease.

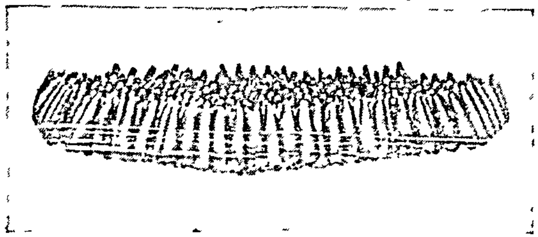
Complex Story of the Malaria Mosquito

The transmission of malaria by mosquitoes is a much more complicated process. This disease is caused by microscopic parasites of the genus *Plasmodium* (*see* Protozoa). In their life-cycle these parasites must pass through several stages and transformations. Half of these transformations can take place *only* in the bodies of men; the other half, *only* in the bodies of mosquitoes. Thus, while yellow fever could be transmitted from man to man by a simple transfer of virus, using, let us say, a hypodermic needle, malaria absolutely requires the intervention of a mosquito. And the mosquito must be of the genus *Anopheles*.

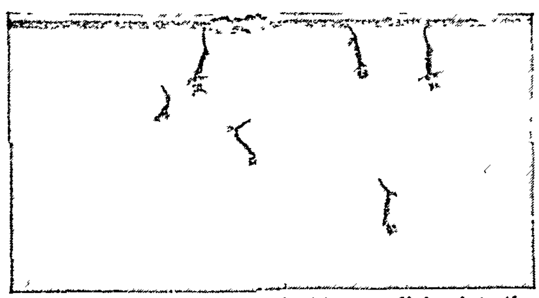
What happens is this: When the *Anopheles* mosquito bites a person afflicted with malaria it draws into itself with the blood some of the malaria parasites in their sexually reproductive stage (*gametocytes*). In the digestive tract of the mosquito these unite and produce egglike cells which burrow to the outer side of the mosquito's intestinal wall. There they change into a threadlike, free-swimming form (*sporozoites*) and make their way up to the mosquito's saliva glands. In mosquitoes other than the *Anopheles*, the parasites are prevented by protective juices from boring through the intestinal wall, and so are destroyed.

When the infected *Anopheles* next bites a human being and injects saliva into the wound in the manner already described, some of the free-swimming malaria parasites are carried across. At once each of them burrows into a red blood cell of the new host. There it grows and divides until it forms from 8 to 32 new parasites (*merozoites*). These burst out of the blood cells, bore into new cells, and repeat the process of growth and division. Within 6 to 15 days after the mosquito bite, waves of about 150 million parasites at a time are breaking

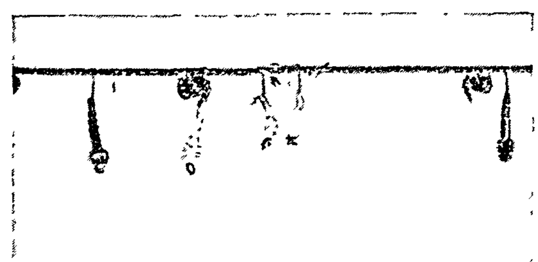
LIFE STORY OF A MOSQUITO



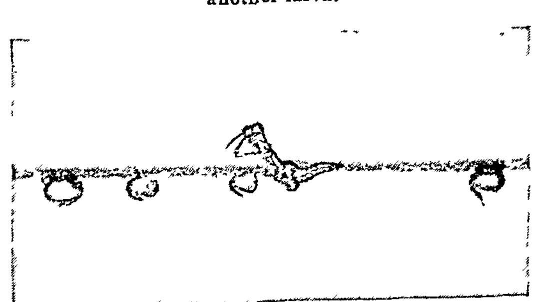
This raftlike mass is a cluster of mosquito eggs, greatly enlarged, floating upon the surface of a pond, and ready to produce mosquito larvae.



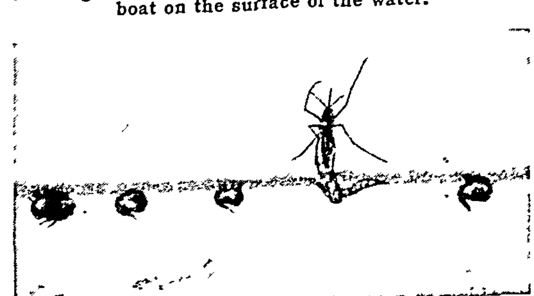
Here are several newly hatched larvae, diving into the water. They are water animals, feeding upon the minute organisms of various sorts, but they must come to the surface to breathe.



Here are several larvae becoming pupae. At the left is a larva. Next comes a pupa, with the empty larval skin attached, then two empty skins, a pupa, and another larva.

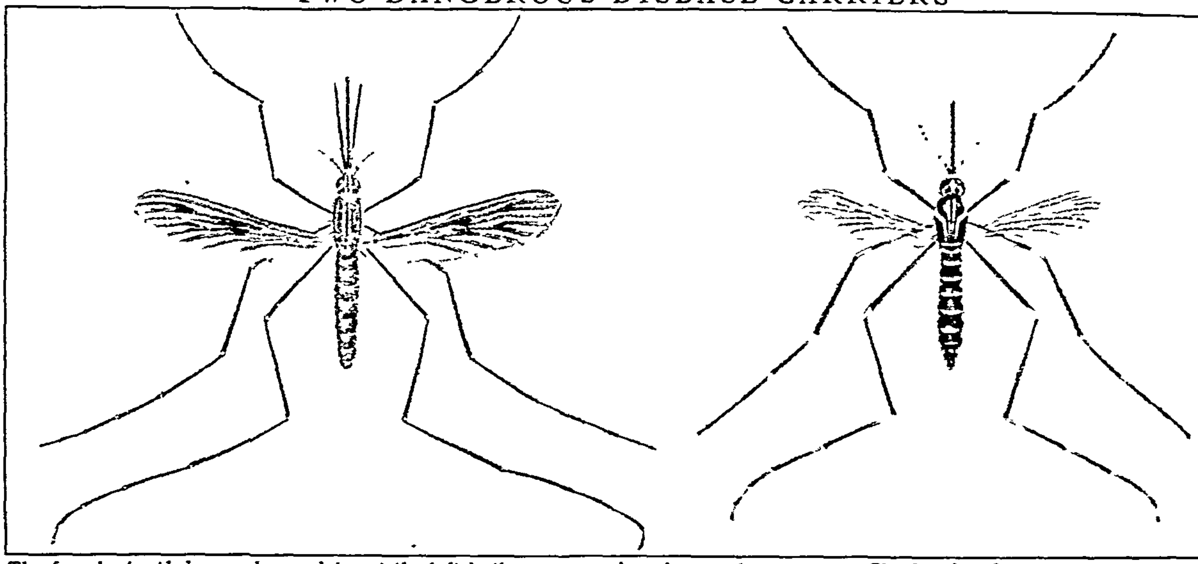


This view shows a newly formed adult mosquito crawling out of its pupa skin which floats like a little boat on the surface of the water.



Before starting on its bloodthirsty hunting life, the mosquito is stretching its legs, drying its wings, and gathering strength for its first flight to land.

TWO DANGEROUS DISEASE CARRIERS



The female *Anopheles quadrimaculatus* at the left is the common American malaria carrier. She has four large spots on each wing. The female of *Aëdes aegypti*, shown at the right, carries yellow fever. On her dark back is a distinctive lyrelike pattern.

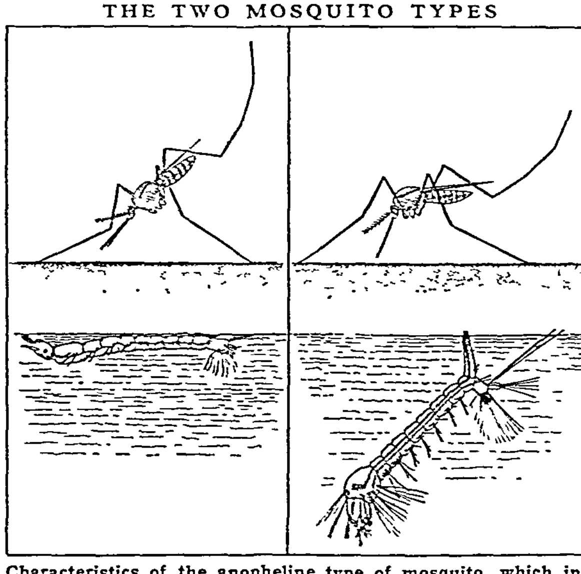
out of blood cells at more or less regular intervals. As they do so, they release poisons into the blood stream. This is what brings about the periodic fevers and chills characteristic of malaria and which used to be called "ague fits."

There are several types of the *Plasmodium* parasites. Some take longer than others in their development in the blood cells, and this accounts for the difference between "tertian" malaria with attacks reaching their peak every 48 hours; "quartan" malaria, with attacks every 72 hours; and other variations of the disease.

Within 10 to 14 days after the first attack, a new generation of sexually reproductive parasites develops in the blood stream of the victim. Thus he is ready to infect the first *Anopheles* that bites him, and so create another possible link in the chain of disease.

Mosquitoes also spread an infective form of elephantiasis. In this disease some part of the body, commonly a leg, swells to gigantic proportions, because the infecting agent, a round worm, blocks the lymphatic vessels. Mosquitoes spread this parasite by contaminating water when they lay their eggs. Dengue, or "break bone fever," is still another mosquito-borne disease. It is common in the tropics, and while rarely fatal it is accompanied by intense muscular pains and eruptions of the skin.

THE TWO MOSQUITO TYPES



Characteristics of the anopheline type of mosquito, which includes the malaria carriers, are shown at the left. When at rest or biting, the members of this group seem to be almost standing on their heads. The larvae lie in the water parallel to the surface. The culicine type, which includes the common house mosquitoes as well as the yellow fever carrier, is shown at the right. Members of this group stand with body parallel. The larvae, however, hang down in the water at a slant.

How Mosquitoes Were Found Guilty

Throughout most of history men suffered from mosquito-borne diseases without being able to do much about them. They recognized some regions as dangerous, especially in certain seasons, and avoided them. After the Spaniards conquered Peru in the 16th century, they learned that quinine, obtained from the cinchona tree, could cure malaria (*see* Quinine); but until men found out the part played by mosquitoes in the spread of these diseases, little progress could be made in checking them.

In the middle of the 19th century, Pasteur and others had proved that certain diseases are caused by living organisms that gain entrance into the bodies of men and animals (*see* Pasteur, Louis; Disease). All infectious diseases were promptly restudied from this point of view, and in 1880 Charles L. A. Laveran, a French army doctor, discovered the malaria parasite in human blood.

The first scientifically based suspicion that mosquitoes might be guilty of spreading disease came in 1881 from Carlos Juan

Finlay, a Scottish-French physician, living in Cuba. He suggested that mosquitoes were responsible for transmitting yellow fever; but he could not prove it, and his theory received little attention.

Meanwhile, studies of the malaria parasites were carried on intensively, and in 1897–98 Maj. Ronald Ross of the British Army in India was able to demonstrate that the *Anopheles* mosquito carries the disease.

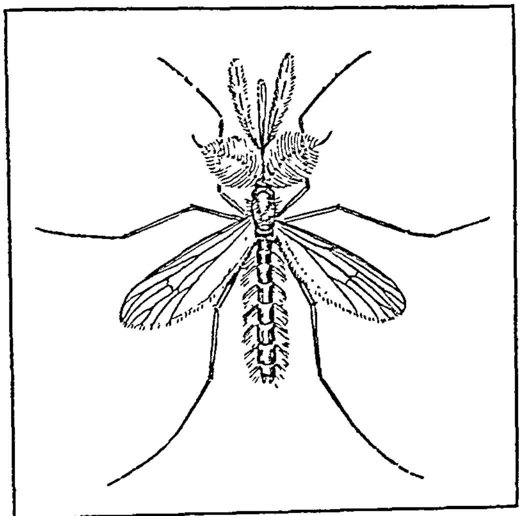
In 1900 the United States Army, which had occupied Cuba after the Spanish-American War, appointed a commission to study the yellow fever epidemics that ravaged the island. The members of the commission were Walter Reed, Jesse W. Lazear, James Carroll, and Aristides Agramonte. In the blood of the victims, they could find no such organism as the malaria parasite. The yellow fever virus was too small to be detected by the means then available.

The commission decided on heroic measures to test Dr. Finlay's 19-year-old theory. They would allow mosquitoes to bite yellow fever sufferers and then healthy men. In the course of the early investigation, Dr. Carroll and Dr. Lazear were both bitten by the experimental insects, and Dr. Lazear died; but more exact proof was needed. One group of soldier volunteers used clothes, bedding, and utensils taken from yellow fever patients, but they were protected against mosquitoes. None of these contracted the disease. A second group lived in clean and sanitary quarters, but each man was exposed to mosquitoes known to have bitten people who had yellow fever. All in this group were stricken. Fortunately none of them died, but their heroism was undiminished by this fact. They had knowingly taken a mortal risk. As a result, the guilt of the mosquito was established beyond question, and men could now fight yellow fever intelligently.

Soon thereafter mosquito breeding places were wiped out in Havana and yellow fever disappeared. Colonel William Gorgas, in charge of the cleanup, later did the same in Panama and so made possible the digging of the great canal (*see* Panama Canal). Today, with mosquito control and the use of yellow fever vaccine, the disease has been driven out of nearly all civilized communities.

In 1941 it was announced that the mosquito *Culex tarsalis* carries the virus of encephalitis (sleeping sickness). The mosquito breeds in farm ponds, barnyard puddles, along the margins of streams, and in the water from irrigation seepage. Several other kinds of mosquitoes were also found to be infected. It is suspected, therefore, that they may transmit the virus of sleeping sickness to man.

THE BADGE OF A MALE



Male mosquitoes have plumelike antennae, which serve as ears to locate the humming females. The male shown here (*Culex pipiens*) is enlarged six times.

As carriers of disease, mosquitoes are an enemy of man, but they are also serious problems in other ways. They cause considerable losses to farmers. Livestock lose weight and reduce milk flow when they are plagued with mosquitoes. Fruit and berry pickers, lumberjacks, road crews, and other outdoor workers suffer loss of efficiency and may even be driven from their work by mosquitoes. Recreational areas are restricted in their use by mosquito annoyance at the time of year when most people are on their vacations.

Mosquito Control

Large-scale mosquito control operations by tax-supported "authorities" are increasing in number. Experts trained in entomology as well as in engineering are finding this a new vocation. The American Mosquito Control Association and several state organizations hold meetings and publish proceedings to exchange information and experience.

Before an effective control program can be undertaken the area must be surveyed. It is necessary to find out where the mosquitoes are and what species are present. The survey studies the lay of the land and natural drainage of the area; the extent and nature of the breeding places; whether these are permanent or temporary; and whether or not it is possible to eliminate the breeding places.

Permanent elimination of breeding places may involve reclamation of land, drainage, diking against floods, or maintaining constant water levels. Such measures, however, are extremely costly. Sanitation may be a control measure. This includes the destruction of tin cans and other containers in which mosquitoes breed. Leaking septic tanks, unused wells, and garbage dumps are breeding areas that can be controlled. In some places brush clearing is effective.

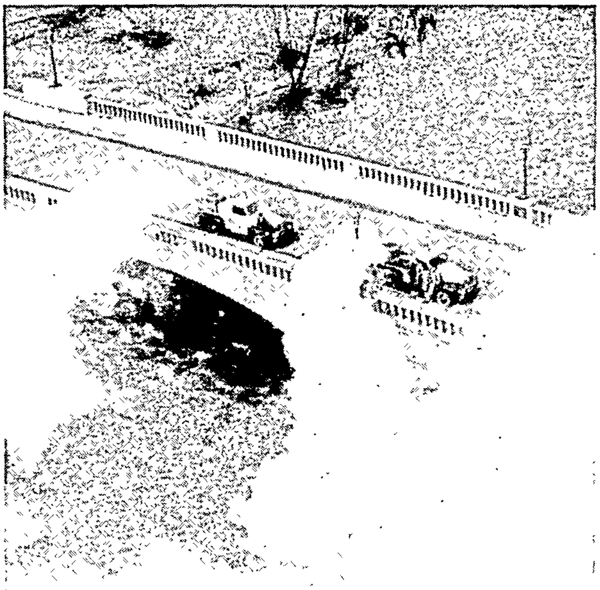
Where the breeding places cannot be eliminated, control may be accomplished by spraying them with one or more of the new insecticides. Petroleum oil was once used against all species and Paris green against *Anopheles*. Pyrethrum sprays are effective in some circumstances. DDT in oil solution has been widely used since the second World War. In time mosquito larvae become resistant to DDT and other chemicals must be used. The insecticides are sprayed over an area either by airplane or by hand and machine sprays.

To protect people against mosquito bites various repellents were developed in the second World War. Applied to the exposed skin and sprayed on clothing, they prevent bites for two hours to half a day. "Space sprays," such as aerosol bombs, protect small enclosed areas for a period of several hours. They

MOSQUITO CONTROL BY HAND SPRAYERS AND FOG MACHINES

Hand sprayers can dust a pond with enough insecticide to kill the mosquito larvae. This is an important step in malaria control.

With a hand pressure sprayer this man is applying an oil solution to a grassy marsh in which mosquito larvae are living.



This demonstration of a fog machine by the American Mosquito Control Association shows how a river can be covered with a dense fog of insecticide to kill larvae and adult mosquitoes.

may be used in a room, a tent, an automobile, or a screened porch. Space sprays are also being used for outdoor picnics and other social functions and in and around amusement centers. They are effective for only a short time.

All sprays should be used carefully. Some of them are harmful to people and domestic animals, as well as to wildlife. They should never be used in concentrations strong enough to destroy the natural enemies of mosquitoes—birds, bats, fish, and the insects which are beneficial to man. Fish are one of the best controls of mosquito larvae, but they cannot survive in waters heavily sprayed with insecticides.

Mosquito Classification

Mosquitoes belong to the gnat family (*Culicidae*) of the fly order (*Diptera*). They are grouped in two subfamilies, the *Anophelinae* and the *Culicinae* (*see* the illustration on a preceding page). The principal malaria carrier in the United States is *Anopheles quadrimaculatus*, which breeds in plant-filled waters and bites after dark. The yellow fever carriers are of the culicine type. The best known is *Aëdes aegypti*, which breeds near dwellings and bites in daylight. One of the encephalitis carriers is *Culex tarsalis*. The common house mosquitoes of the United States are *Culex pipiens* in the north and *Culex quinquefasciatus* in the south, both night biters.

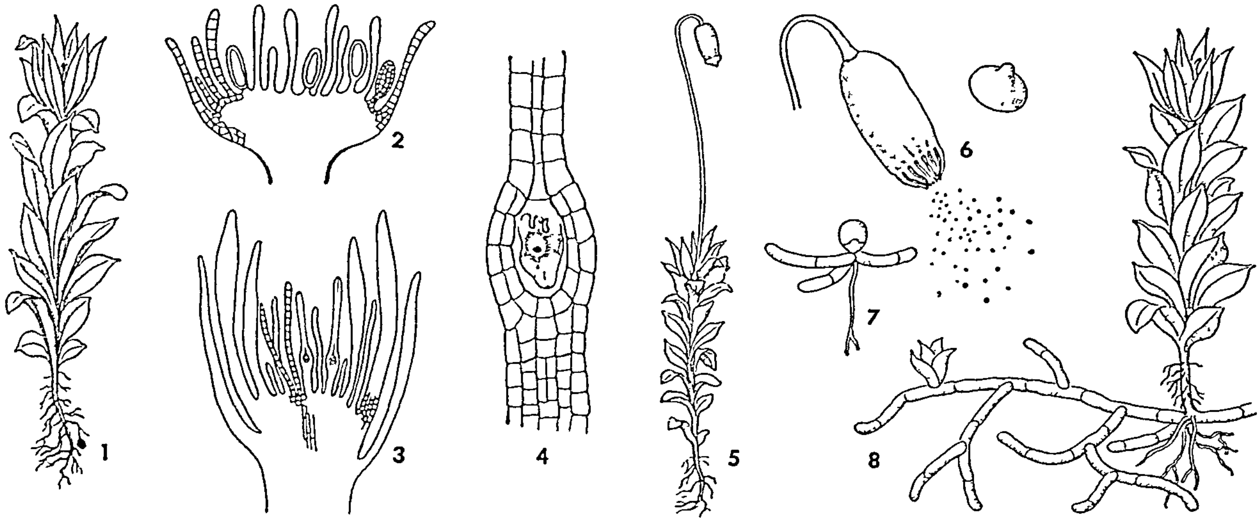
MOSS. The mosses form beautiful green carpetlike expanses on the forest floor. Some are like brilliant green rosettes on decaying logs, wet boulders, and dripping cliffs in ravines and gorges. Others, the sphagnum mosses, are pale green, almost white masses in bogs and swamps. Mosses are very small plants. Each resembles a tiny tree, with a single straight trunk and delicately formed leaves growing out from it all the way from base to tip.

Each moss plant is held in the soil and absorbs moisture and minerals from the soil by means of a number of little threadlike roots called *rhizoids*. Some mosses, instead of standing erect, trail over the ground like velvety vines, which interlace and form a dense mat. Mosses as a rule dwell in moist places. Their habit of growing compactly together makes it possible for them to hold large quantities of water in storage, much as a sponge does.

How Mosses Reproduce

Botanists call mosses "flowerless" plants because they do not bear flowers and seeds. They make new plants by means of spores instead of seeds (*see* Spore). Each moss plant grows up from a small green threadlike trailing structure known as the *protonema;* this sends up buds which grow into the leafy moss plants we know. In the tips of some of these moss plants grow structures called *archegonia*, in which eggs develop. In other moss plants grow structures called *antheridia*, in which sperms develop. When the plants

THE CURIOUS LIFE CYCLE OF THE MOSSES



The leafy mosses develop sex cells in a ring of modified leaves at the tops of the plants (1). One plant produces sperm-bearing male organs called "antheridia" (2). Another plant produces "archegonia" bearing egg cells (3). A male cell fertilizes an egg cell (4). The fertilized cell develops into a spore-bearing plant (5), which grows out of the top of the leafy female plant. At the top of the stalk is a capsule (6), which contains the spores. When it is ripe, the lid falls off (it is shown to the right of the capsule). The spores scatter like salt through the teeth of the capsule. The fringe of teeth is called the *peristome*. A spore falls to the earth and germinates (7). It grows into a protonema (8) from which buds a new leafy plant.

are covered with a film of water, the sperm swim by means of hairs (called *cilia*) over to the archegonia and there fertilize an egg cell. From a fertilized cell grows another sort of plant. It takes root in the top of the archegonial plant where the egg was developed. It is a thin green stalk. On the top of the stalk develops a capsule (*sporangium*) covered by a lid. The capsule contains spores. Spores correspond to the seeds of higher plants, but they are extremely small. A mass of them resembles a little cloud of dust. When the capsule is ripe its lid opens, and the spores are scattered about by the wind. A spore which falls to earth in a warm, moist place develops into a protonema. Thus the cycle is completed.

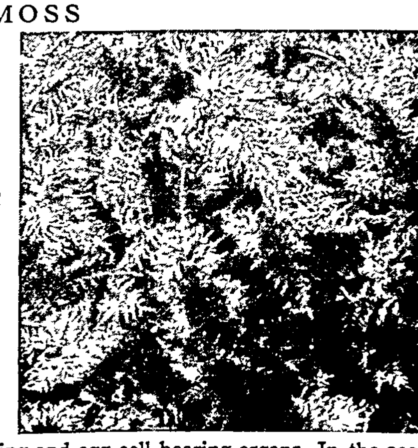
Botanists call the familiar green leafy plant the *gametophyte*, meaning the plant body bearing the sex cells. The plant which bears the spore case is the *sporophyte*. The process by which a plant bears sex cells in one generation and spores in the next is called *alternation of generations.* Ferns and liverworts have a similar life cycle.

Mosses are often confused with the liverworts, which also grow in damp places and are of the same delicate green color. Liverworts may be distinguished from mosses by their thicker leaves, which look rather soft and fleshy, and which usually lie flat on the ground, with little hairlike rootlets on their under surfaces (*see* Liverwort). Irish moss is not a moss but a seaweed. Iceland moss and reindeer moss are not mosses but lichens (*see* Lichens). Club mosses are related to ferns (*see* Ferns). Florida, or Spanish, moss is a flowering plant.

The Many Kinds of Mosses

Thousands of kinds of mosses are known. They grow throughout the world in every kind of habitat from swamps to deserts and high mountains. Most of the familiar kinds, however, are found in moist places. They are divided into two groups, the sphag-

BEAUTIES IN A BIT OF MOSS



Under a microscope the mosses are beautiful and interesting plants. At the left, *Mnium hornum* appears to bear flowers. These are actually clusters of leaves in the center of which are the sperm-bearing and egg-cell-bearing organs. In the second picture are spore cases of *Bryum capillaris.* The moss on the right, *Hypnum tamariscum,* looks like a tangled forest.

num, or peat, mosses and the true mosses. Sphagnum mosses are of considerable value to man. They are pale green, almost white. Their spongelike leaves, filled with hollow cells, absorb liquids quickly. Hence they make an ideal surgical dressing with which to pack wounds. Large quantities were used for this purpose in the first World War. They are also used as packing for plants which must be kept moist in shipping. Mixed with garden soil, they lighten it and help it to hold moisture.

Sphagnums grow in large patches in damp meadows, bogs, and swamps. When they occur along the shores of a lake or pond, they often gradually fill up the whole area with their spongy growth. Such a filled-up pond is called a quaking bog, because it trembles and quakes when one walks upon it. Growths of sphagnum accumulating through thousands of years formed the deposits of peat found in England, Ireland, and other countries (*see* Peat).

Of the true mosses, one of the best known is haircap moss, or pigeon-wheat. It grows erectly to a height of several inches. Pincushion moss grows in a dense, round clump. Plume moss resembles a green ostrich plume. The fern moss looks like a tiny fern, but with a heavy spore-bearing stalk.

At the present time mosses seem rather humble members of the plant kingdom. However, they played a great part in making the land fit for animal habitation. After the most primitive plants (algae and fungi) had carpeted the bare rocks and by heaping up their dead bodies provided a little store of nutritive soil, the mosses and liverworts appeared and took up the work. In time their remains provided a rich soil and thus made possible the growth of higher plants (*see* Plant Life). The mosses and the higher plants together formed the material which supported animal life on land. Mosses still exercise this regenerative function after great catastrophes, such as volcanic eruptions, strip the land bare of life.

Mosses and liverworts together comprise the plant division *Bryophyta*, a Greek word meaning "moss plants." Liverworts belong to the class *Hepaticae*, mosses to the class *Musci*. The *Musci* are divided into three orders, *Sphagnales* (sphagnum mosses), *Bryales* (true mosses), and *Andreaeales* (a rare group of alpine mosses). Two species of sphagnum common in North America are *Sphagnum compactum* and *Sphagnum acutifolium*. Haircap moss, or pigeon-wheat, is *Polytrichium commune*.

MOTHER GOOSE. Who was Mother Goose? Nobody knows, yet everyone of us is acquainted with her rhymes. A widely circulated story declares that the original Mother Goose was a certain Elizabeth Goose (or Vergoose), a Boston widow. It is claimed that she sang these ditties to her infant grandson, and that the lad's father, who was a printer, published them in a book at Boston in 1719. No trace of such a book has ever been found, however, and long before that date the name "Mother Goose" was used in France in connection with various stories and myths of a folklore character.

The first mention of this French "Mother Goose" is found in an old French poem of 1650:

> But the joyous theme in use,
> Like the tale of Mother Goose,
> In myth and fable so abounds
> It quite bewilders and confounds.

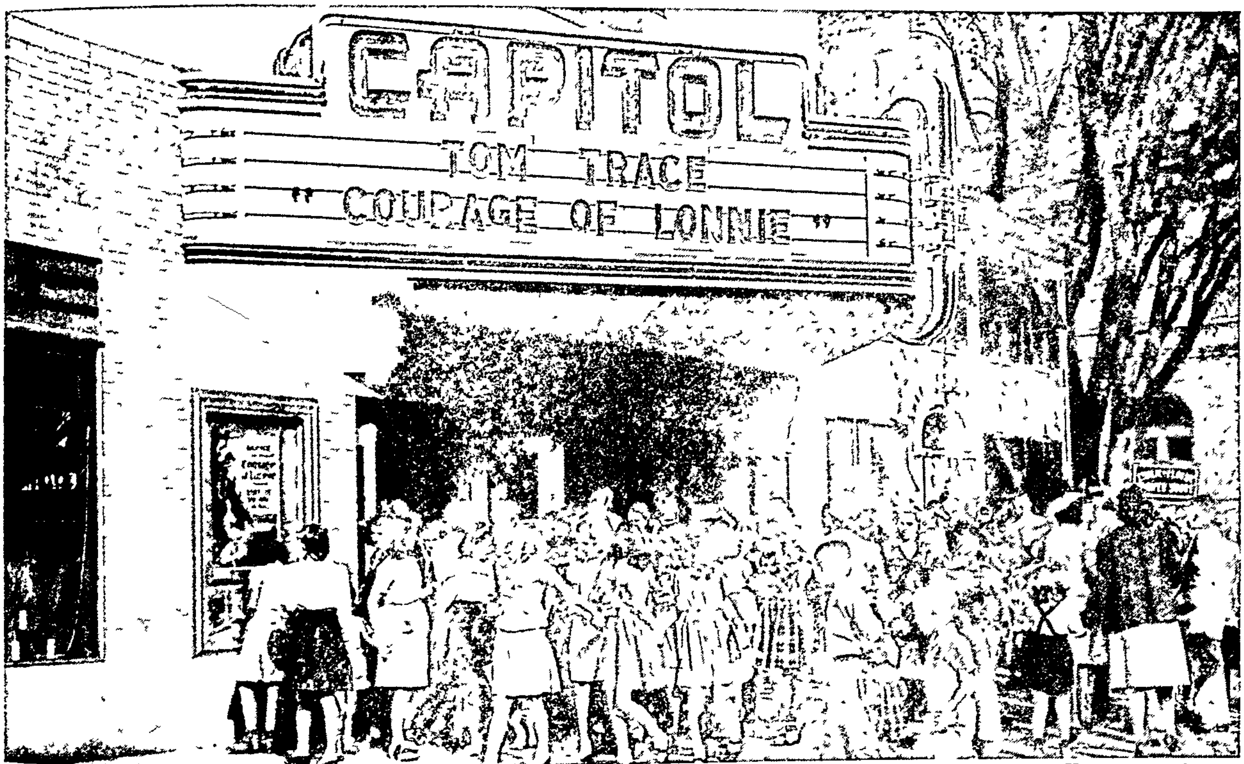
In 1679 a French writer named Charles Perrault published a book of fairy stories under the title 'Tales of Passed Times, by Mother Goose'. It contained such stories as "The Master Cat" (our "Puss in Boots"), "Little Thumb" (our "Hop o' My Thumb"), "Sleeping Beauty," and "Blue Beard." This book proved very popular and was soon translated into English. In this way the name "Mother Goose" became known to English children.

Many of the rhymes and jingles which make up our Mother Goose's melodies were already well known in England. Like all folk songs and sayings, they had been passed on from generation to generation. Finally, in 1760, a London publisher named John Newbery transferred the popular name "Mother Goose" from the fairy stories to a collection of these nursery jingles, and the rhymes have ever since borne the name of this mythical authoress.

No copy of this 1760 edition is in existence, but there is a reprint of it which bears the date of 1791. It is a tiny volume, about $2\frac{3}{4}$ inches long by $3\frac{3}{4}$ inches wide. It contains 51 rhymes, each furnished with a tiny illustration. The first American edition of Mother Goose was published in 1785, at Worcester, Mass. It is an exact reprint of the Newbery book. In 1833 a Boston publishing firm published an enlarged version, with more than twice as many jingles as were in the Newbery collection. Most of the new ones are evidently very very old. Many of them were probably copied from an English book, 'Gammer Gurton's Garland', published in 1810. (*See* Newbery.)

Many learned men and women have given loving study to the history of these old familiar nursery rhymes. "Sing a song of sixpence," they tell us, is found in a play written in Shakespeare's time. "Jack Spratt" was a very fat churchman. "Little Bo-Beep" is an old, old children's game, in which one child shuts her eyes and the others hide from her. "Little Jack Horner," according to some, was an Englishman who secured a rich estate (the "plum") from the church in the time of Henry VIII. "Old King Cole" was a legendary British prince in the old Roman days. There was once a whole "chap-book," or early booklet, about "Simple Simon." "Three blind mice" is found in a poem published in London in 1609. "Tom, Tom, the piper's son" is in a song published in 1719. The manuscript of "Old Mother Hubbard" was discovered in 1936. The verses were written and illustrated by Sarah Catherine Martin in 1804, while she was visiting the country home of her brother-in-law, a member of Parliament. She was inspired to write it by the clever antics of a dog belonging to the housekeeper. So every one of these quaint jingles is seen to have its own special history.

The FASCINATING *World of* MOTION PICTURES



A crowd of young movie fans in front of a theater is a familiar Saturday afternoon sight all over the country. Young people particularly enjoy the picture about a dog being shown at the theater above, as well as Westerns and other thrilling action movies. Probably their parents will attend the theater in the evening. The movie theater provides pleasant recreation for the whole community. The motion-picture industry is a huge one and it supplies the entire world with pictures.

MOTION PICTURES. Any evening in the week we can see a band of riders thundering across the plains of the old West, watch a famous scientist at work in his laboratory, or laugh at the antics of a comedian. We can see the great events of history unfold, travel to the far places of the world, or study the daily lives of people at home. For all these wonderful experiences, we need only to visit some neighborhood motion-picture theater.

There in the comfortable darkness we forget ourselves and become absorbed in the vivid drama before us. The figures on the screen loom to giant size, and the sound of their voices fills the theater, commanding our whole attention. For two hours or more, a new and interesting world of fact and make-believe unrolls before our eyes.

Why We Enjoy the Movies

What makes the motion picture such a fascinating form of entertainment? First, everything on the screen appears to be lifelike and natural. The movie characters walk and talk just as people actually do. The rooms, houses, and streets seem real. Second, the story itself is full of interesting action. Something happens every minute. The picture does not stand still at one scene. It moves around, "describing" as it goes. Thus action and description move forward together.

When the people in the story must move from place to place, they are transported in an instant. If the story skips over a period of time, the interval is bridged with ease. Music makes the story more exciting, and other sounds make it more real. Best of all, everything blends smoothly into an entertaining show.

In addition to the full-length (*feature*) picture, the movie program offers newsreels and other short subjects. Newsreel cameramen all over the world capture striking pictures of the day's happenings and speed them back for instant showing in theaters. Short subjects such as *documentary* films give more detailed studies of how people live and work. Other "shorts" are one- or two-reel comedies, travelogues, or sports demonstrations.

Almost every community in the United States, no matter how small, has a movie theater or a hall where movies can be shown. Except in large cities, the motion picture is often the only kind of show available. Films can be brought by mail to isolated places which are otherwise cut off from the outside world. They can be shown on moving trains, on shipboard, and even in open fields. Thus for a great many people everywhere, going to the movies is a pleasant habit.

Motion pictures can also give instruction in countless ways. Schools and industries use a wide variety of educational films, showing such subjects as how a bill becomes a law in Congress, how a flower grows, and how to repair a motor. A story may be woven through the demonstration to drive home the lesson.

Scientists record laboratory experiments in motion pictures, often using special high-speed cameras and extremely sensitive film. Films are taken to record the techniques employed in difficult surgical operations. From them, doctors and medical students can

MOVIES ARE NOT ALL MAKE-BELIEVE

The motion picture can also bring real happenings to the screen, as shown here. At the top, a high-school student practises driving in a "dummy" automobile, while a film shows passing cars. The light panel shows how he reacts to the traffic. A daring newsreel cameraman (center) stands up close to film a dangerous gasoline fire. Natural history students (bottom) get a good look at a raccoon on the screen. Classroom films like these are available on many subjects.

learn new methods to heal the sick. Advertisers tell the merits of their products in motion picture story form. Animated cartoons are often used for these same purposes.

The Secret of Movement in Motion Pictures

Motion pictures can tell stories and present demonstrations because they can show people, animals, cars, and other things moving in a lifelike, natural way. The secret of making pictures move can be demonstrated by constructing a little movie "thumb book." Directions for making one are given on a later page.

The key to understanding the motion is simple. First notice that the frog is in a slightly different position on each picture. If you turn the pages slowly and study each picture as it comes up, you see them just as they are—*still* pictures. Flipping the pages, however, just as fast as your thumb can release them seems to bring the pictures to life. The frog really seems to jump from one pad to the next and finally falls with a splash.

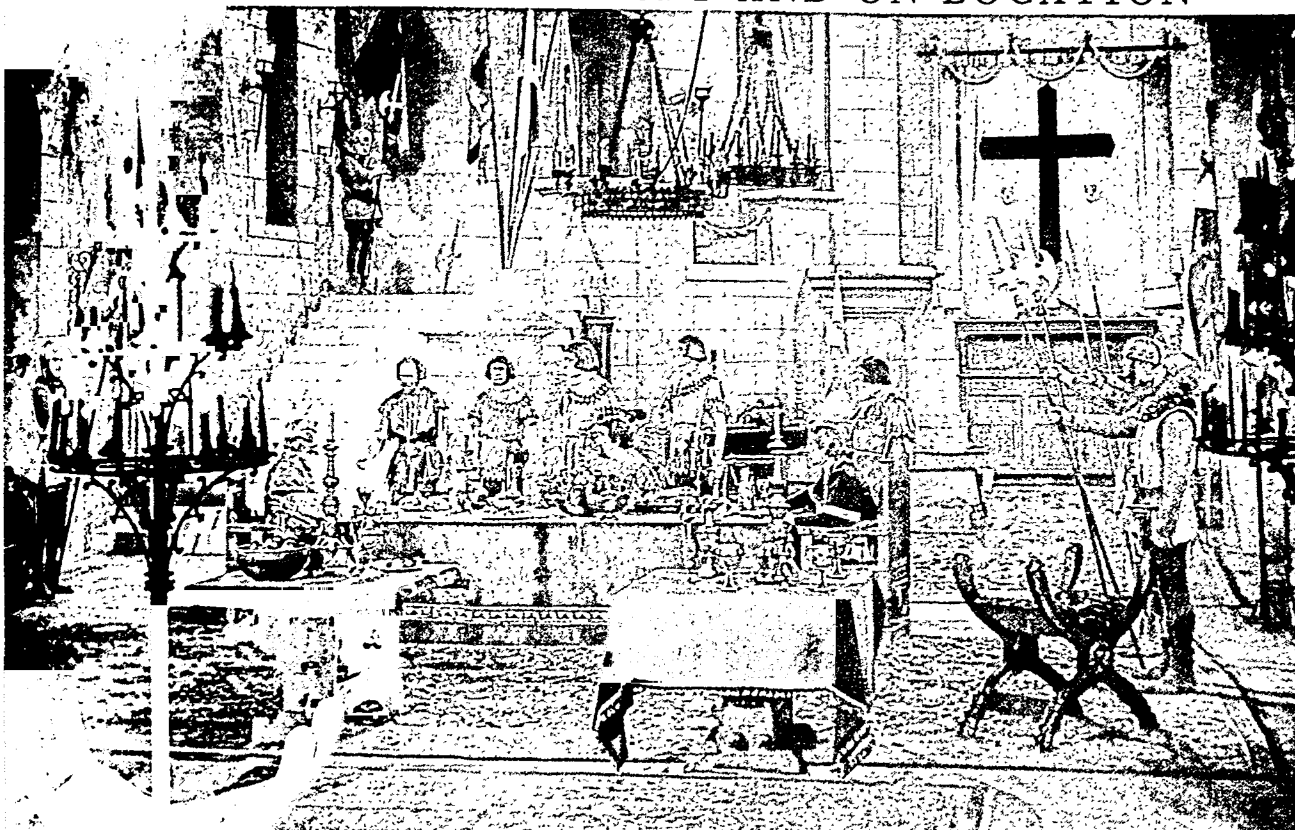
What happens to bring this appearance of motion? When you turn the pages slowly, enough time passes to clear one picture from your mind before you look at the next. When you *flip* the pages, the time between pictures is too short for this. One picture is still in your mind when the next one comes before your eyes. The position is slightly different in the second picture, and for that reason the frog actually appears to have moved from one position to the next.

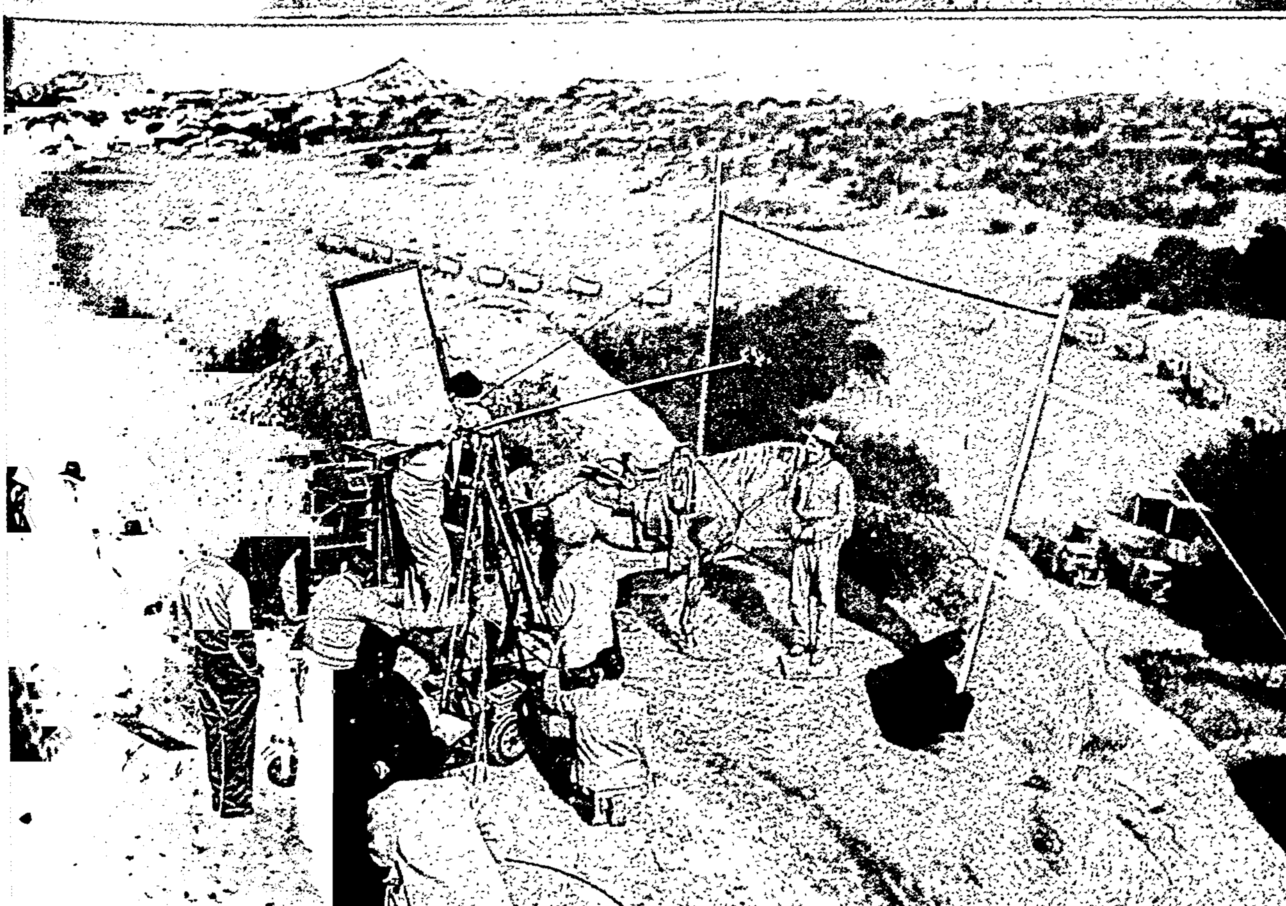
How Persistence of Vision Helps

This appearance of motion is helped by something that goes on in eyes and mind as you watch the movie thumb book or a real motion picture. When a picture strikes the eyes, it registers an image on the delicate eye tissues, and the nerves carry an impression to the brain. This image takes a little time to die out after the picture is removed—about $\frac{1}{16}$ of a second. If the picture is in view for a shorter time, $\frac{1}{25}$ of a second for instance, the image still lingers in the eye for $\frac{1}{16}$ of a second.

This lingering is called *persistence of vision.* It is the real reason why motion pictures "move." When pictures with people (or moving objects) in slightly different positions

RICH COLOR ON THE SET AND ON LOCATION





This scene (top) from the motion picture 'Prince of Thieves' (Columbia) shows the interior of a castle during Robin Hood's day. The elaborate indoor set is furnished with historically accurate objects. Months of work go into choosing the furnishings and the harmonious colors. This view (bottom) shows a scene from the picture 'California' (Paramount) being filmed on location. The background is the natural beauty of the California hills, helped only by filters and screens to insure well-lighted pictures.

"FILM" FOR A HOMEMADE MOVIE

are shown faster than 16 a second, persistence of vision keeps each picture in the eyes while the next few are being shown. Thus the eyes hold images of several pictures, with a slight shift of position running through the set. If the shifts are gradual, the mind and eyes will convert them into smooth-flowing motion.

How a Movie Is Filmed and Shown

Once we see how a movie can produce the appearance of motion, it is easy to understand how a motion picture is taken and shown. The film itself is a long ribbon of the same material as roll films for ordinary cameras. When light from an object passes through a focusing lens and strikes the film, it makes a picture of the object on the film. A series of pictures can be made by exposing one section of the film, blocking off the light, moving the film along for the next picture, exposing the new section, and so on.

This is what a motion picture camera does. It has a lens and a shutter for blocking off or admitting light. It also has a mechanism which moves the film along. This mechanism grips the film by the holes along the sides. The movement of the mechanism is timed with the shutter movement. Together the two move and expose the film 24 times a second. The film is exposed for only a fiftieth of a second or less for each picture; the rest of the time is taken up by the movement. In this tiny period, even rapidly moving objects look as though they were standing still. Thus altogether, the film registers 24 still pictures a second, with a very slight change from one picture to the next.

After the film is exposed, it is developed, and a print is made on a second film. This film can be used in a projector to throw the pictures on a screen. The projecting process is a reversal of the taking process.

In the projector, the film moves along between a strong light and a lens which focuses the pictures on a screen. A mechanism, similar in purpose to the one in the camera, moves each picture into place and holds it there for an instant. During this instant a shutter opens, and the light throws the picture through the

You can make these pictures flash before your eyes in real movie style by constructing a little "thumb book." With a ruler, draw a set of 21 squares like these. Then copy the simple drawing in each square. Cut the drawings into separate squares and paste each one on a card or stiff sheet of paper, close to one edge. Hold the stack of cards in one hand, and flip the edges with the thumb of the other hand. With a little practise you can make the pictures run together to show continuous action.

lens and onto the screen. Then the shutter closes while the picture is being moved. This action is repeated 24 times a second.

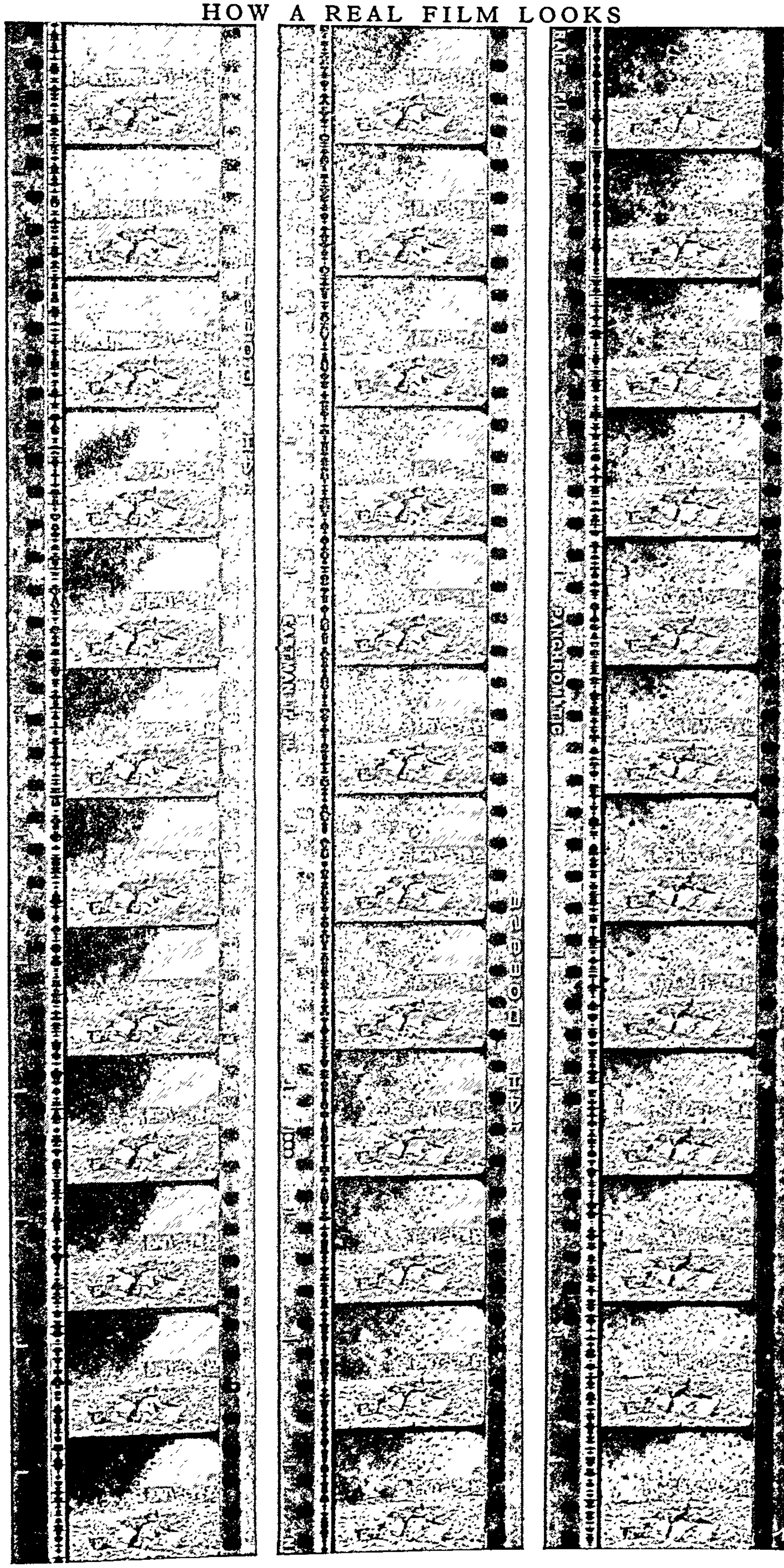
Thus the projector shows the same 24 still pictures of action which the camera caught. As we look at the projected pictures on the screen, our eyes do their part with persistence of vision; and we see the smooth-flowing action just as it took place before the camera.

At the same time that the actors are photographed, their voices are recorded on film. The recording process begins when a microphone catches the sounds and turns them into electrical variations. The variations then guide a beam of light that leaves a picture, or sound *track*, on a film. For projection, the sound track is printed along the edge of the picture film.

In the projector a light passes through the sound track and is converted to electrical variations. A loud speaker behind the screen turns the variations back to the original voices and carries them to the audience.

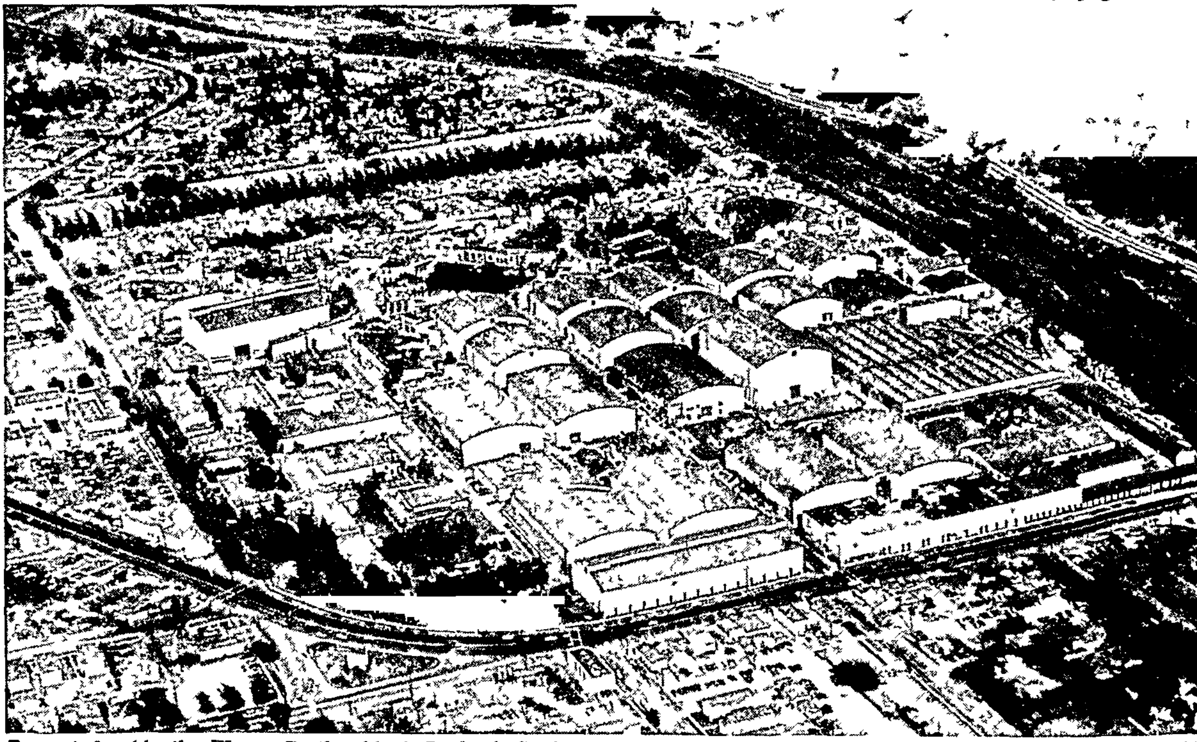
The best place to see how all these processes work is in a real motion-picture studio. Here famous actors and actresses perform before precision cameras against a background of realistic scenery. Working with the players are hundreds of people who help prepare the show for the camera "eye" and "ear" and who assemble and print the films for theater showing. The largest studios are located in the movie capital of the world—the so-called Hollywood district in and around Los Angeles, Calif.

HOW A REAL FILM LOOKS



Here is a section of real film from a war movie ready for showing. The film is reproduced in actual size. Notice how small the change is from frame to frame. This is so because the frames shown here flash by in little more than a second. To the left of the pictures is the sound track; along the sides are holes for pulling the film through the projector.

Inside the Motion-Picture Studios



From studios like this Warner Brothers' lot in Burbank, Calif., come motion pictures for audiences all over the world. The huge buildings that look like airplane hangars are sound stages. Permanent sets fill the rear of the lot.

A MOTION PICTURE studio can be large or small; but a "Hollywood" studio of a large company is almost a manufacturing city in itself. It has an orderly arrangement of streets marking off the sections, with buildings of all sizes along the streets. These contain sound stages, work shops, film vaults, dressing rooms, and offices. One section may even have a small pond for photographing water scenes.

When the pioneer movie companies first moved to California, many of them built studios in the Hollywood section of Los Angeles (*see* Los Angeles). As the industry grew and the Hollywood district became completely built up, many companies moved to sites in less crowded neighborhoods. Today seven of the ten largest Hollywood studios are located in suburbs of Los Angeles and not in Hollywood at all. But the name is still used to mean a studio in the Los Angeles district, wherever it may be.

Many People Help Make a Movie

A large studio may employ as many as 5,000 people, although some of them may be hired only for temporary work. The actors and actresses who appear on the screen are far outnumbered by directors, cameramen, writers, artists, technicians, and business people. Producing a movie requires work by people representing more than 275 trades and crafts.

A few of the occupations that contribute to a single movie are shown in the list of screen credits at the beginning of the picture. A typical screen credits list begins with the name of the studio and the stars and feature players, then identifies the author of the original story and the writer who adapted the story for the screen. Next may come the cinematographer, the special-effects men, the art director, the composer of the background music, the music director, the film editor, the sound engineer, and the costume designer. In a prominent place at the end of the list come the producer and director.

Of course, the list will be different for a newsreel, a picture showing scenery, or one that explains a process or activity. But the great majority of movies tell stories for entertainment; and the work of producing them can be followed roughly in the order of the credits on the screen.

Where the Movie Begins

Every full-length (*feature*) picture starts with a story. The work of finding suitable screen stories reaches around the world. Studio story departments search the output of books, magazines, and plays everywhere. A single studio may examine as many as 20,000 stories a year and use only from 20 to 50 of them. The companies control this work from Hollywood, but many of them maintain story offices in New York, London, and other key cities. In foreign countries, native readers look for screen material.

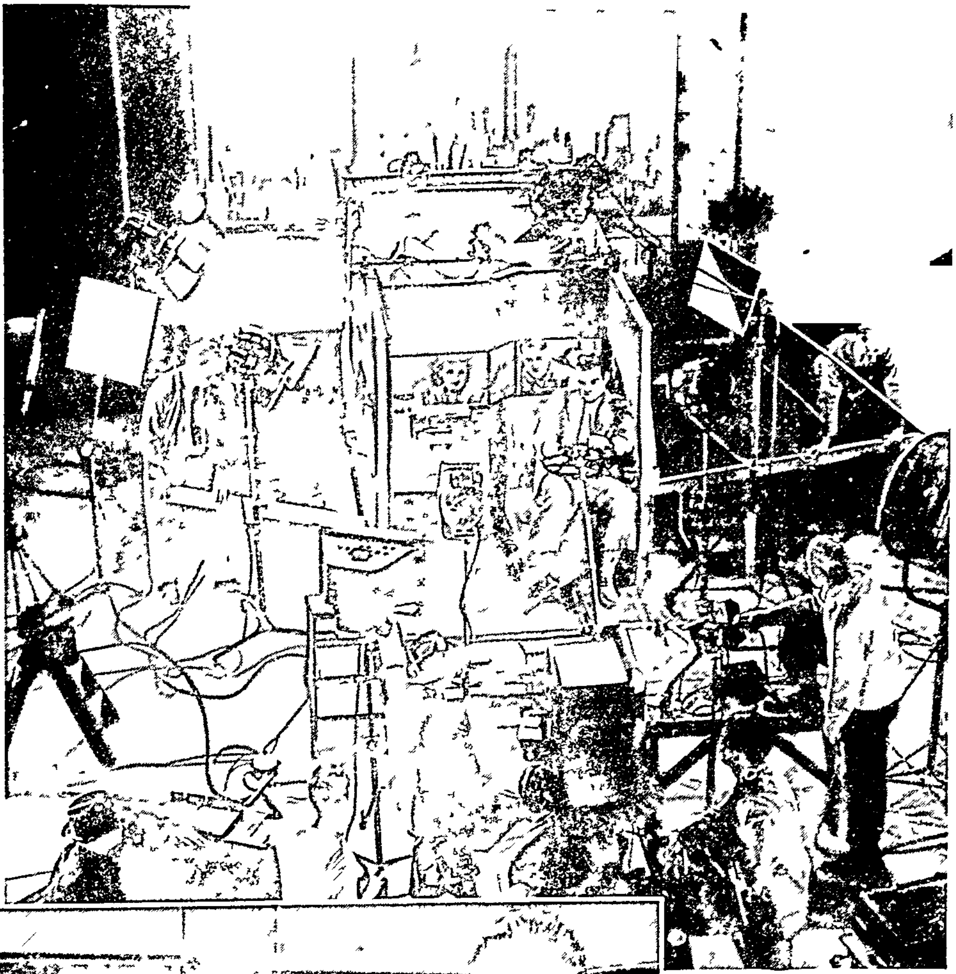
Many of the stories come from novels, magazine stories, radio dramas, and stage plays. In such cases, the studio buys the right to use the story for a screen play. Others are *originals*—that is, stories written for the screen and not published elsewhere. These originals are often inspired by historic events or by current happenings of dramatic interest.

The first task, after a story has been obtained, is to adapt it for picture production A *screen writer* does this by turning the story into a screen play. (The play may also be called a *script* or a *shooting continuity.*) Often several writers will contribute to the play before it is accepted in final form by the producer.

The screen play describes every scene in detail. It tells what the actors will say, what they will wear, and where each scene takes place. It also indicates approximate positions of the actors and the camera and how the actors will move during filming. Last, the screen play tells in what order the scenes will be shown. This is important, because all the scenes that take place on one set or location are filmed before the company moves to the next set. At the end the scenes are assembled in story order

Thus the screen play is not only a story; it is a working plan for producing the picture. From it the studio executives can decide on the budget, the cast, the sets, and the costumes. They can also foresee some of the technical problems that must be solved as the picture is made. Screen writers are recruited from the ranks of professional writers, and often an author or playwright comes to Hollywood to help adapt his own story.

HOW WE SEE IT—AND HOW IT'S DONE



The scene showing people riding down a New York City street in a taxicab (left) was not taken in New York or in a taxicab. The top picture shows how the scene really was filmed in Hollywood. The "taxi" is a mere frame open in front for the camera. Men on each side gently rock the frame to simulate the motion of a taxi. Wind machines give a fresh breeze, and arc lamps throw an outdoor light through the taxi On the screen the whole scene appears completely real.

The Producer and the Director

The *producer* is in charge of making a movie from the time the story is obtained until the completed movie is ready for distribution. He acts mainly as a business manager, although he may contribute to the creative work done on the picture. *Executive* producers have charge of a number of pictures, with separate producers for each one, working under him. Men who are chief executives or sole owners of movie companies are also called producers.

The *director* is the man in charge of "telling the story" on the screen. He too begins work long before filming starts. He confers with the screen playwright while the script is being written. When the screen play is accepted, he works with art directors, costume designers, and all others who must make preparation before filming ("shooting") begins. During the filming, the director coordinates the work of everyone on the set. When shooting is completed, he helps the film editors bring the picture to the form and length shown in the theaters. Some directors may be producers for their own pictures.

Many directors are famous for their individual methods, and often a good director specializes in one

REHEARSING UNDER THE DIRECTOR'S EXPERT EYE

Here the noted director Cecil B. DeMille coaches a group of actors for a scene from a costume picture. Before the scene is filmed, the director rehearses the actors until he is sure they will play the scene well. Once satisfied, he steps aside and the cameramen and soundmen make their records of the action and dialogue.

type of picture. One director may handle only stories with a romantic theme. Another may specialize in murder mysteries, and a third in Western action pictures. The public never sees the director, but many people have learned to know and appreciate his work.

Getting Ready to Shoot

Before a picture is filmed, the studio puts in months of patient and detailed preparation. Using the screen play as a plan, the various studio departments construct and assemble everything needed for filming. Much of this work is carried on under the supervision of the *art director*.

The art director begins by making sketches of settings and costumes. After these have been approved, accurate working drawings are made. Then special craftsmen make small-scale models of the sets. With these, the director and cameraman can plan the movements of the actors and cameras.

Meanwhile the property department assembles furnishings from its vast store of furniture, books, china, and hundreds of other items. It also has pistols, saddles, flags, and other *hand props*—articles handled by the actors. The prop men refinish old properties and make new ones as the studio's program of pictures may require.

The wardrobe department makes costumes for some of the players. Actresses' gowns are often designed by leading dressmakers, and these gowns sometimes set new fashions. Other costumes may be taken from stock or rented from a costume company. The research department checks the authenticity of all settings and costumes. When the picture has a background requiring specialized knowledge, a technical expert is consulted.

As the work continues, the art director must see that the spirit of the story is carried out in the settings and costumes. If the picture is a comedy, a feeling of gaiety must be maintained with bright colors, open and sunny rooms, and a prevailing tone of freedom and movement. If the story is a tragedy, dark colors, gloom, and a feeling of oppression must be emphasized.

Building for the Camera Eye

Working from plans and models, studio carpenters and painters construct the sets. Other craftsmen provide the room furnishings and such special effects as cobwebs, snow, and grass. These men can "plant" a forest of trees on a studio lot for one picture, then turn the same floor space into a representation of a well-known street in New York or Paris.

Unlike an architect or an interior decorator, the art director does not create real buildings or rooms. His sets are open on one or more sides so the cameraman can film the scene from several angles. He rarely places ceilings over rooms. The space is often left open so lights can play down on the scene. The construction is also limited only to what is needed to make the picture.

House fronts are mere shells braced from behind. Elaborately carved panels are simulated with plaster molds. Miniatures are used where possible to avoid costly full-scale structures. Storm-tossed ships are generally represented by toy-sized boats in a small

MOVIE MAKE-UP IS A FINE ART

A movie actor's make-up must appear to be a real part of his skin and features, even under the close inspection of the camera. Here a make-up artist is delicately applying a scar to Boris Karloff's forehead for one of the latter's "monster" rôles.

1. This exact duplicate of the lower levels of a cathedral is used for close-up scenes in a film. For long-range views, pictures of the actual upper levels are superimposed by matte shots, as described in the text. 2. Here is how a studio makes rain for a seashore scene. 3. One corner of the properties room is filled with elaborate statuettes. 4. An art director makes a model for a large set. 5. A star's gown receives finishing touches by the costume designer and his assistants.

RECORDING ACTION ON FILM

Here are three important steps in filming on the set. An assistant cameraman (top) measures the distance from actor to lens to insure good focus. An electrician (center) under the cinematographer's direction, adjusts a huge spotlight above the set. With everything ready (bottom) the action is filmed. The director sits beside the cameraman.

pond, with wind machines creating waves and spray. A picture of a city being demolished by earthquake is taken with buildings of doll-house size. By clever use of the laws of proportion, the appearance of reality is maintained. Unless the moviegoer is aware of all these devices, he never suspects that he may not be seeing the "real thing" on the screen.

The sets are assembled in a huge building called a *sound stage.* The floors, walls, and ceiling of this building are constructed in several layers to absorb echoes and keep out noise. Sometimes *baffles,* or portable walls, are placed around the set itself to control the sound.

Acting for the Movies

All studios have under contract a number of *stars*—popular actors who play leading roles. Often stories are bought for a particular star, and the screen play is prepared to suit his individual talent and personality. Supporting roles are filled by actors under contract or by *free lance* players who are engaged for a single picture. *Extras*—people who stay in the background and who rarely have lines to speak—are hired by the day

Acting in front of the camera is far different from acting on the stage, although stage experience is extremely helpful. One difference is that screen actors do not go through the play from beginning to end as stage actors do Each scene is rehearsed and photographed before work begins on the next one. Since a single scene usually runs only two or three minutes, the actors learn only a few lines of dialogue at a time. Nor are the scenes filmed in story order. Sometimes a company acts out the end of a story before it begins work on the opening scenes.

Stage actors have an audience in front of them. They must exaggerate certain gestures and raise their voices to reach the audience. Such acting would be ruinous in a movie. Actions and speech must be suitable for the camera and sound recorder.

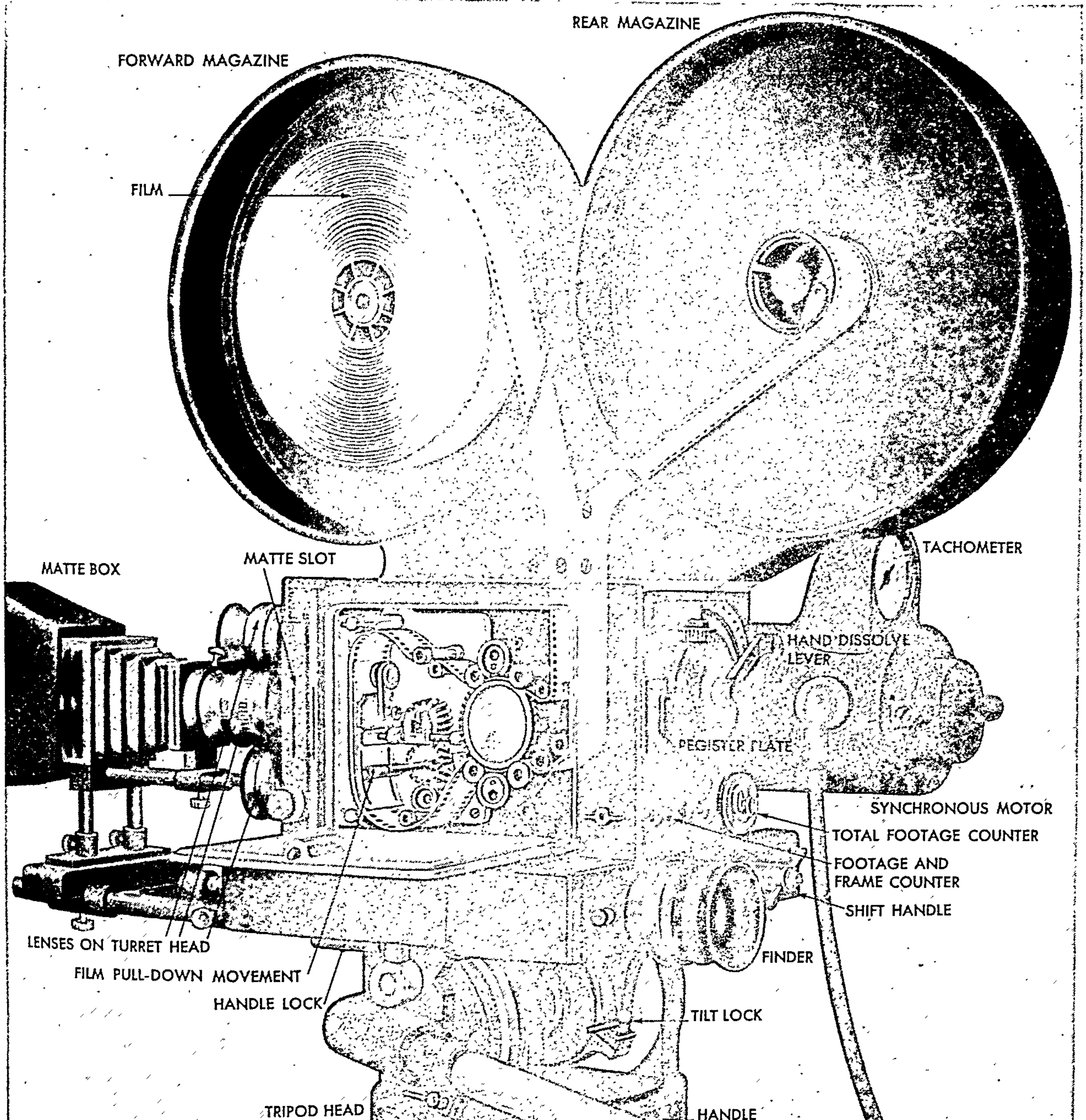
The Art of the Cinematographer

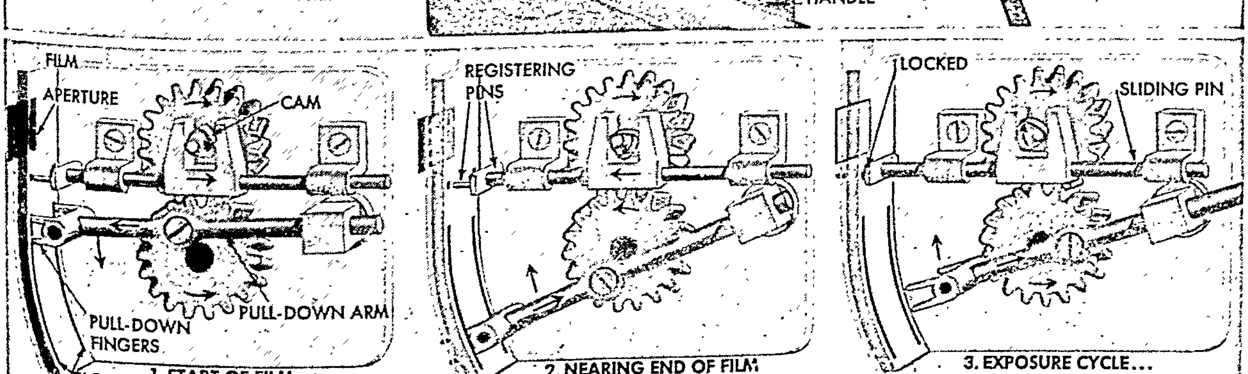
As the story is acted out, it must be recorded on film. This work is done by *cinematographers.* Cinematographers do not act merely as photographers. The chief cinematographer, called the *director of photography,* rarely touches a camera, his assistants do the actual filming. His work consists largely of planning how to use the camera to get the most effective pictures.

In the early days of moviemaking, the camera stood rigid and the actors moved before it as though they were on a stage and the camera was the audience. Gradually directors and cameraman learned to follow the actors with the camera, just as a spectator follows a real action scene. They turned the camera on its mount from side to side (*lateral panning*), up and down (*vertical panning* or *tilting*), forward for *close-up* shots, and back for wide-angle *long shots*

This ability to move enables the cameraman to get the most dramatic pictures of each scene.

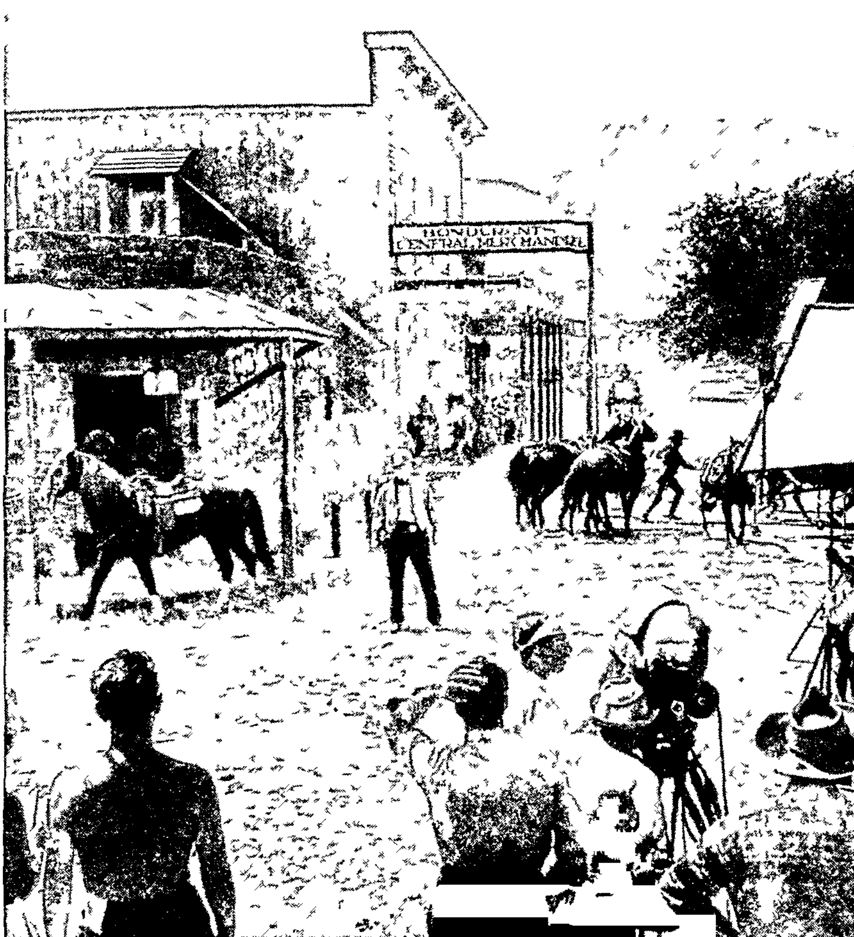
INSIDE THE COMPLEX MOTION PICTURE CAMERA





This picture of the movie camera shows how the film passes from the forward magazine, through the camera for exposure, then back to the rear magazine. The film is moved and held for exposure behind the lens and shutter by the film pull-down (*intermittent*) movement. How this works is shown in three steps at the bottom. At the start of the cycle (1) the pull-down arm pushes fingers through slots in a guide strip which holds the film. The fingers engage holes in the film, then move down in the slots. Near the end of the cycle (2) the film is almost in place for exposure. Next (3) the gears move the registering pins forward to lock the film and draw back the pulldown arm. At this point the shutter opens, exposing the film. Meantime the pull-down arm is returning for a repetition of step (1). The whole cycle takes place in one twenty-fourth of a second. On the camera itself are the matte box, matte slot, and hand dissolve lever. These are used for making various kinds of process shots described in the text.

FILMING AN EXCITING WESTERN "ON LOCATION"



This action scene for a Western movie is being filmed in a studio-built "town" in the California hills. The real-looking stores are actually only front and side walls held up by braces from behind. The camera of course sees only the realistic exteriors. The large white screens at the right throw reflected sunlight on the players.

In a close-up shot he can let the camera catch an actor's facial expressions. Using the long shot, he can record widespread action, such as a battle scene. By pointing the camera skillfully, he can draw attention to any particular point of action demanded by the story.

The picture on the previous page shows how a standard movie camera for taking black and white films is constructed. The Technicolor camera, for taking full color pictures, works on the same general principles, except that it employs three films. Directly behind the lens a prism and colored filters separate the colors into three images, each selecting a basic color. Each color makes a separate impression on its own film. After developing, the three negatives are printed together on a composite color film.

Lighting the Set

Like all photographers, the cinematographer wants proper light on each scene. The light must both illuminate the set and sustain the spirit of the story. The electricians and their assistants the *juicers* work under him. He shows them where to place the lamps and how to regulate them during filming. For a gay comedy scene, he floods the set with a bright glow. To bring out dramatic values, he casts long shadows and uses spotlights to concentrate attention.

The electricians use carbon arc lamps for direct beams and incandescent lamps for broad illumination. They regulate the amount of light with rheostats called *dimmers*. To diffuse or reduce the intensity of the light, they place silk or gelatin screens in front of the lamps. Other types of screens block out a portion of the beam or prevent reflection. Electric power comes from a studio powerhouse or a portable generator. A studio uses as much electricity daily as does a fairly large town.

Filming on Location

Many movies are filmed away from studios, in places called *locations*. These may be studio-owned property, such as ranches for Western pictures, or they may be actual cities or towns. The locations provide a realism sometimes impossible to get on the studio set. The whole company lives on location until filming is completed.

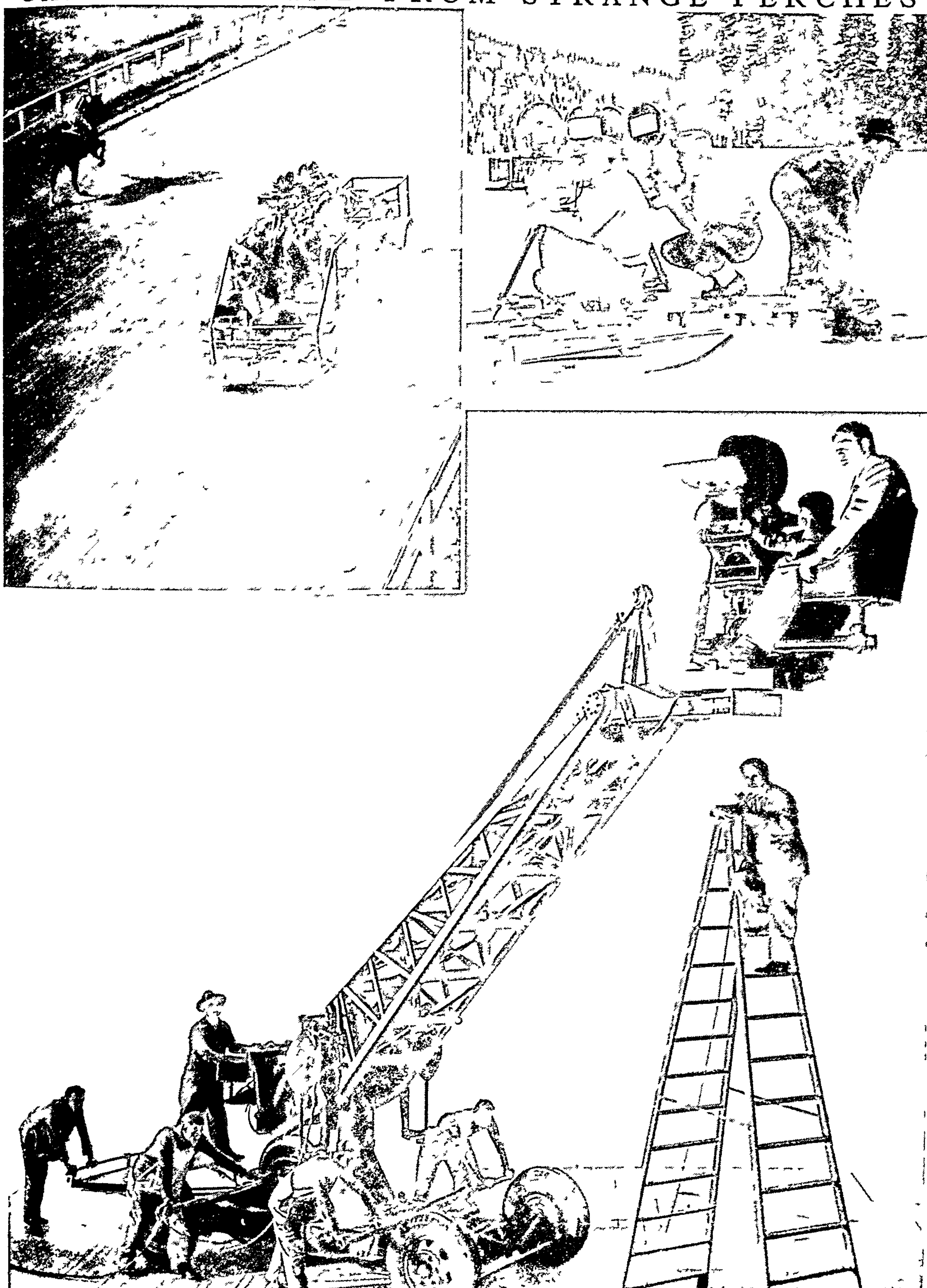
Sometimes cameramen go on location to film background scenes for a particular movie or for the studio film library. The shots, called *transparency process* shots, are used in special effects cinematography. Occasionally a *double* resembling a star, is filmed with long shots on location. Later in the studio, the close-up shots are made with the star.

Tricks of the Special Effects Cameraman

"I don't believe my eyes!" people exclaim when they see an actor face to face with himself on the screen. Yet an actor can easily play two rôles in the same scene with help from a special effects cameraman. Before shooting, the cameraman masks half his lens with a black shutter called a *matte* to prevent the exposure of half of each frame of film. With the open half he photographs the actor playing the first rôle. The actor himself plays as though the other character were really opposite him. Then the cameraman rewinds the film and changes the matte to the other half of the lens. Now with the unexposed half of the film, he shoots the same actor playing the second rôle.

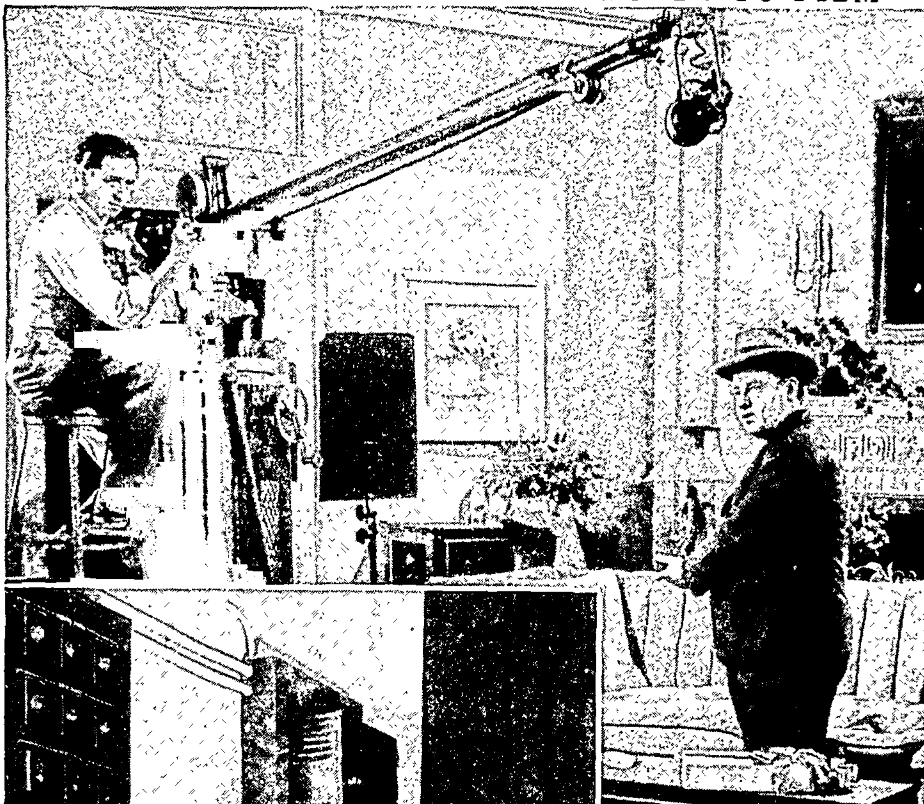
Odd and eerie effects can be achieved by *double exposure*. The result on the screen may be a ghostlike and transparent figure that passes through walls and closed doors. First the room itself is photographed.

CAMERAS GRIND FROM STRANGE PERCHES



Cameramen mount their equipment on a variety of devices to film scenes from unusual angles. At the upper left, a camera crew follows a horse and jockey around a racetrack. At the upper right, cameramen film winter sports with cameras mounted on skis. In the bottom picture, a cameraman and director overlook action from their perch at the end of a crane. The crane swings from a movable dolly, or truck.

TRANSFERRING THE ACTOR'S WORDS TO FILM



In the upper picture a microphone hangs from the end of a long boom above the set. The man at the left guides the boom to keep the "mike" over the actor's head throughout the scene. The sound is transformed into electrical energy and travels to the recordist's booth (bottom picture), some distance from the set. Here the recordist controls the sound as it is transferred to film.

Then the actor is photographed on another film against a black background. The two films are developed, and on the second negative the black background shows clear. Now the second film is laid over the first, and the two are refilmed together with a camera called an *optical printer*. The new film shows the actor moving with ease through solid objects.

Process shots enable cameramen to film Hollywood actors in any place in the world—without leaving the studio. One method uses the location background scenes. Another method uses a painting or enlarged photograph as a background. The set is furnished with realistic reproductions of objects blended with the background. A third method uses a motion picture as background. The movie is projected on the back of a transparent screen. It shows through on the front of the screen as part of the set.

The matte process is also used to match a studio-built set of the lower stories of a building with photographs or paintings of the upper stories of the real building. On the screen the structure seems real.

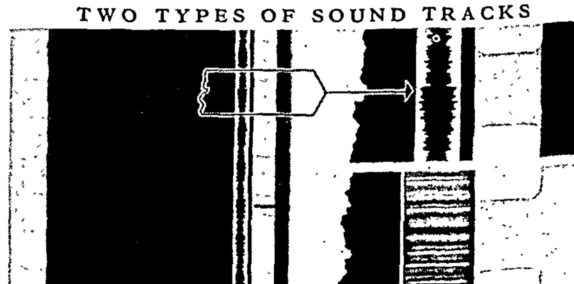
"This Is a Take!"

On the morning that shooting begins, the actors report early to the *make-up* department. For most rôles, make-up is applied only to hide small facial blemishes and make the actor more attractive. The make-up artist uses false hair and various cosmetics to bring about these changes. Sometimes, however, the actor's features must be entirely altered for a certain rôle. The artist then uses a wig, puttylike substances to build up the nose and cheekbones, and cosmetics to add new lines and shadows to the face.

The actors know their lines when they arrive on the set. Under the director's guidance, they first rehearse the scene. The cinematographer studies the rehearsal with a *finder*, a viewing device that enables him to see the scene exactly as the camera will during filming. An assistant cameraman marks the floor with tape, indicating where the actors pause in their movements.

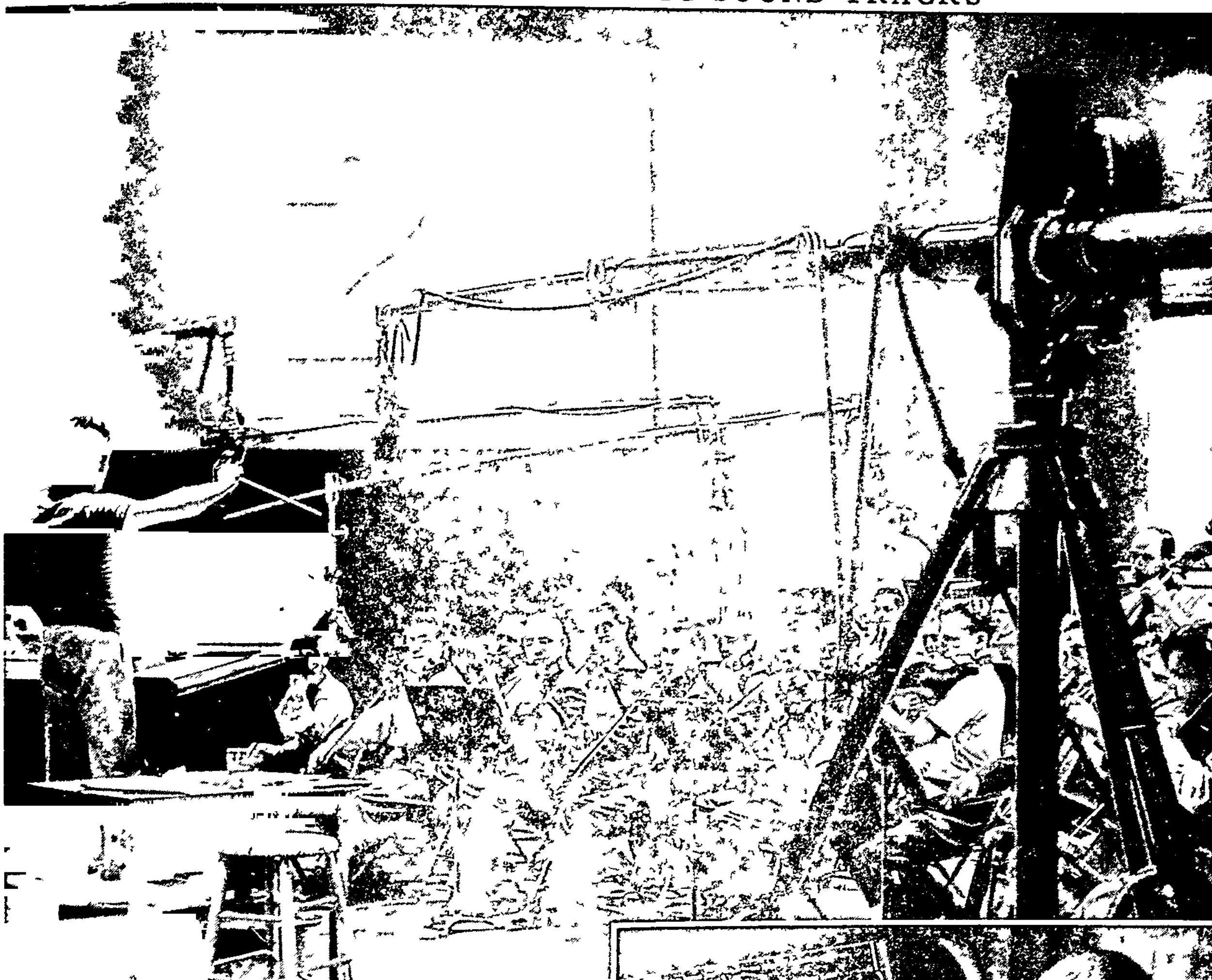
The actors then leave the set; and *stand-ins*—people who resemble the actors in stature and coloring—take their places. They stand on the taped marks while the juicers adjust the lights, the cameramen

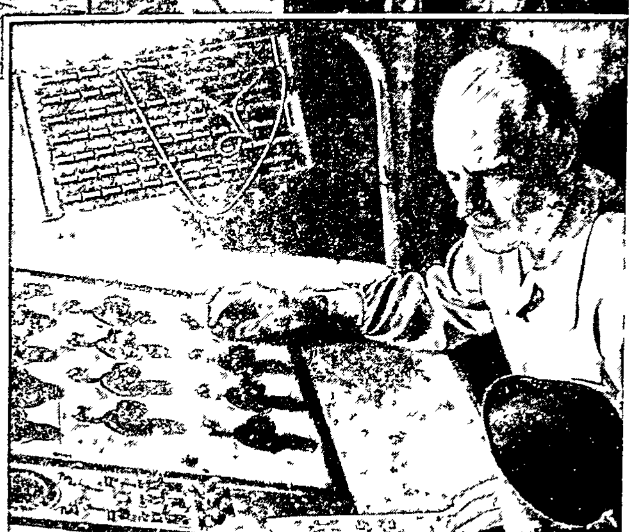
TWO TYPES OF SOUND TRACKS



The actual size film strip at the left shows a variable area sound track. At the upper right is an enlarged portion of the track. The section at the lower right is an enlarged portion of a variable density track. Both tracks are formed by action of a light beam on sensitive film, as explained in the article.

MAKING SEPARATE MUSIC SOUND TRACKS





A studio orchestra (top picture) is playing specially arranged music for a scene. Later the music will be blended with dialogue that was recorded on the set. The large numeral "2" tells the musicians to begin playing the second section of the score. Notice the microphones hanging from booms. A monitor controls the volume as it is being recorded (bottom picture). He follows the playing with an abbreviated score.

focus their lenses, and the sound men fix the microphone boom. After this, the actors return for a final rehearsal. When the director is satisfied, he orders filming to start with the command, "This is a take!"

Filming for the Ear

While the action is being filmed, voices and other sounds must be recorded also. This means that something must be placed on film to re-create the sound in the theater. The work begins by picking up the sound on the set. To catch the actors' voices, the sound crew places a microphone over their heads.

The microphone picks up the vibrations of speech and converts them to variations of electrical energy. This conversion of sound to electricity in the microphone takes place in much the same way as in a telephone transmitter (*see* Telephone). The electrical variations travel from the microphone by cable to a sound-recording camera located in a soundproof booth or sound truck. Here the electrical variations cause variations of light intensity corresponding to the original voice vibrations from the set. The beam acts on sensitive film and leaves a record of its movement, called a *sound track*.

The track may be a *variable density* or *variable area* type. The picture on the previous page shows how they look. A movie projector can use either type.

PREPARING FILMS FOR EDITING

Left, a technician works with a semiautomatic sound printer. The machine prints from the black negative track onto the white positive film. The actual work takes place in the dark. Right, an assistant film editor studies the separate picture and sound films before running them in the Moviola before her. The dome-shaped device is the soundhead.

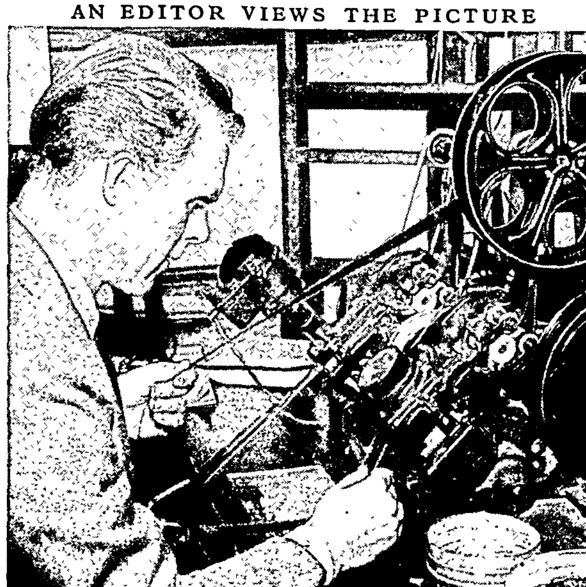
The sound crew usually consists of three men. One man moves the boom to keep the microphone over the actors' heads and clear of the area being filmed. The second man, called a *mixer*, wears headphones to hear the sound as it comes into the microphone. He uses a controlling device to regulate the volume and quality of the sound before it goes to the recorder. The third man is the recordist. He operates the recording apparatus. When the director orders shooting to begin, the recordist starts both camera and sound recorder from a switch in his booth. This action makes certain that both instruments start at exactly the same instant and that they run together during filming.

When the day's shooting is completed, positive prints (*rushes*) are made for showing the next morning. Negatives and positives are treated in much the same way as ordinary still camera roll films (*see* Photography). To handle the long reels, special winding devices keep the film running continuously through the various treatments. The rushes show whether the day's work was satisfactory. If not, retakes are usually made immediately.

Putting the Scenes in Story Form

After all the filming is done, the work of the *film editor* begins. The collected scenes may total as many as 30 reels and these must be reduced to 10 while still preserving the story. The film editor, with the director and producer, eliminates all the superfluous and ineffective parts of each scene. Sometimes whole scenes are discarded. At the same time, he adds sound effects, music, and many other devices to clarify the meaning and heighten the mood of the story.

AN EDITOR VIEWS THE PICTURE

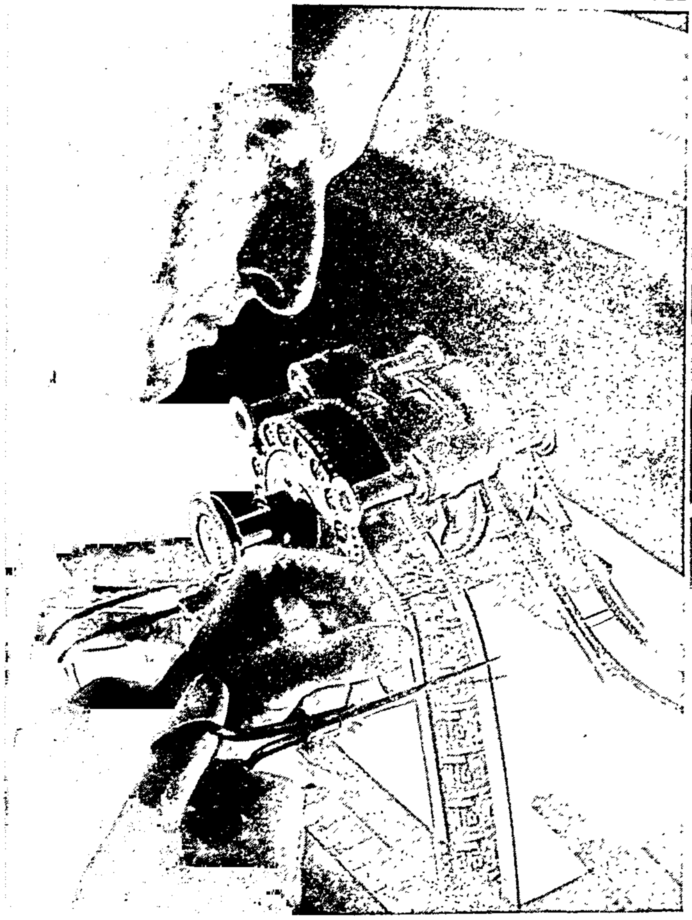


For a speedy view of a scene, the film editor runs the film through a Moviola. He sees the picture, slightly enlarged, through the viewing lens in front of him, and the sound comes from a separate soundhead at the side.

One of his favorite ways to build suspense is to *intercut*. He combines two separate scenes to build up an interest that neither scene has by itself. For example he can combine a scene of a stalking tiger with one of a sleeping child, flashing from one to the other until the audience realizes the danger. The scenes are filmed separately, of course, and the child is frightened by nothing more than the cameraman.

The film editor may start a scene by allowing the picture to emerge gradually from a black background. This is called a *fade-in*. He may close a scene by letting it *fade out* into an instant of darkness. To bridge the interval between scenes, he uses a *lap dissolve*. This is a method of double-printing the end of one scene over the beginning of the next, so that the transition is smooth.

CUTTING AND PRINTING THE COMPLETED MOVIE



The expert film editor at the left is cutting out portions of film to speed up the story. Note how he makes similar cuts in both picture and sound films. In the laboratory above, men make positive prints of the edited movie that will be for theater showing. Their work actually takes place in darkness.

The editor may also use a *montage*—a series of very short scenes—to tell part of the story. For example, scenes of a speeding train, names of cities, newspaper headlines, theater programs, and applauding audiences may be combined to tell the story of a singer's successful tour. A combination of suitable sounds accompanies the picture montage.

Sound Effects and Music

Not all the sounds in a movie are recorded on the set. Only voices and noises coming from the actors and other sources that the audience sees appear on the original sound track. Other sounds such as traffic noise and thunder are added after the picture has been cut and edited. Every studio keeps a collection of these sounds recorded on film or disks. The editor selects sounds from the collection, or has new ones made. These are combined with the original sounds on a new track.

Adding background music is called *scoring*. This music is composed especially for the picture to bring out comedy or drama. It is also used to foreshadow action and to build up climaxes. Sometimes a movie is *prescored*—that is, the music is recorded before the scene is filmed. Then the music record is played back on the set, and the actors, dancing or walking, can keep time with the music.

Often songs are recorded separately on special recording stages. Later, as the song is played back on the set, the singer and the orchestra are filmed. This method is also used to substitute or *dub in* the voice of a good singer when an actor who does not sing well is required to play a singing rôle in a movie.

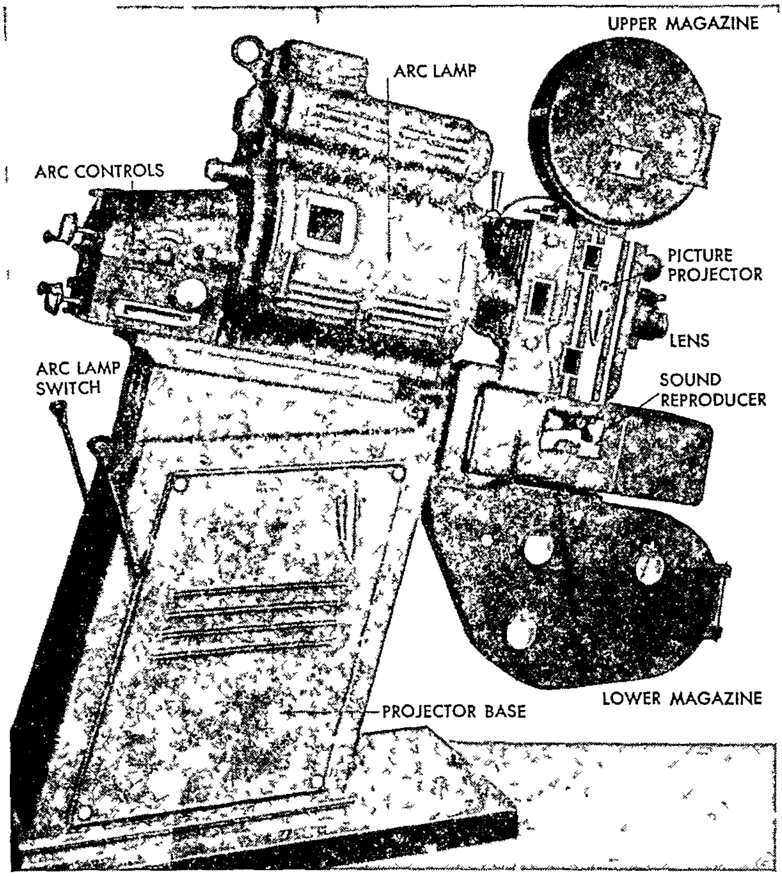
DEVELOPING AND FIXING FILM

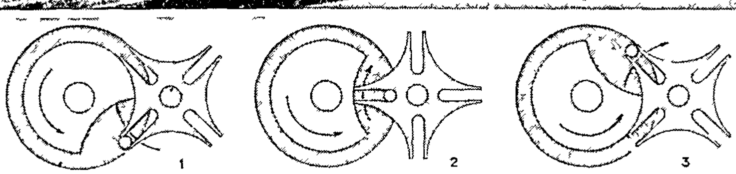
Rows of film run in continuous reels through these tanks of developer, hypo, and washing water. Later they are placed in the drying cabinets at the side. Both negative and positive films are treated in this way.

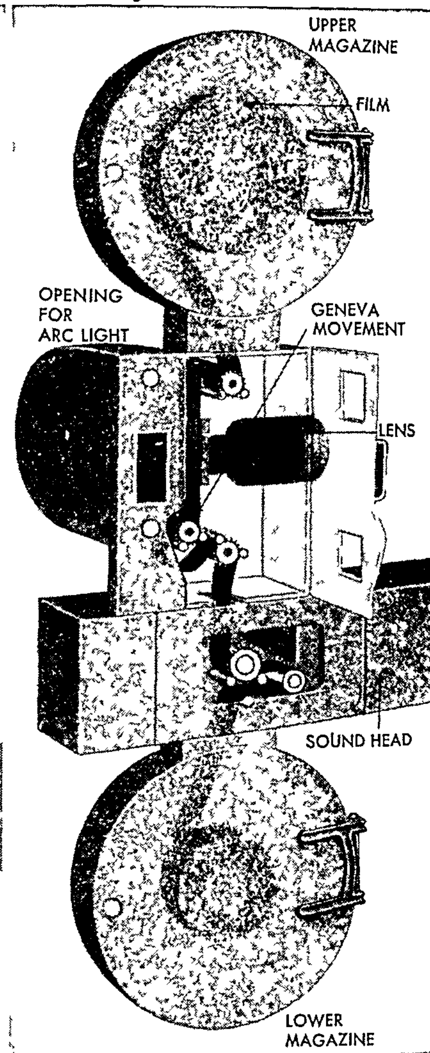
The film editor and his assistants cut and edit positive prints of the film, called *work prints*. These are made from the master negatives which are cut only when the final prints are ready to be made. The picture is on one strip of film and the sound track on another. Each print is on a separate reel about 1,000 feet long. After the work prints of both picture and sound track have been edited, the final step is to make a composite film of both tracks. (Home movie film can now be bought that has a magnetic strip along the side. This records and plays back the sound.)

Hollywood studios make several hundred prints of each

PICTURES AND SOUND FROM ONE PROJECTOR







Upper left, this RCA projector is built on a slant to throw pictures from the projection booth onto the theater screen The other pictures on these two pages show how it works Right, part of the projector is opened to show the film passing from the upper to the lower magazine. As each frame passes the lens, the shutters fly open. This permits the light beam from the arc lamp to pass through the film and lens and project the picture onto the screen. Farther down the film passes through the soundhead. Because the soundhead is some distance below the lens and shutter, the sound track for each frame is printed 19 frames ahead Thus the pictures and sound are projected together. Lower left, this Geneva escapement device provides the intermittent movement that holds the film in place during the projection A stud on the revolving wheel engages a slot in the "star" (1), turns it at a speed increasing to maximum (2), and then leaves it in the projection position (3), ready for a repetition of the movement

movie for distribution in the United States and foreign countries. If a popular movie is reshown after several years, new prints may have to be made from the master negatives. These films are 35 mm. wide. This width is suitable for use in standard projectors in movie theaters. Smaller portable projectors use 16-mm. and 8-mm. films. Sometimes prints of regular features are made for these machines, but mainly they are used for educational and home movies.

Showing Movies in the Theater

Almost any darkened hall will do for showing motion pictures. The modern movie theater, however, is especially designed so that movie patrons can see the screen clearly, hear the sound well, and be comfortably seated during the performance. The auditorium temperature is kept at the right level for the season, and fresh air is circulated by large centrifugal fans or air-conditioning units. Many theaters provide extra conveniences such as candy counters, checkroom service, and parking spaces for patrons' automobiles

The floor of the auditorium slopes gradually from the rear doors toward the front wall that holds the screen. The slope is sufficient to permit people in the rear to see the screen over the heads of the people toward the front. Many theaters have a stage platform directly below the screen. On each side of the auditorium are emergency exits, marked with red lights. All doors open outward so that people can leave quickly in any emergency.

In the Projection Room

High on the back wall of the auditorium is the projection booth. This small fireproof room contains two projectors, each with its own porthole in front. These machines are operated by a skilled *projectionist.*

While one projector is showing a reel of film, the projectionist has the other machine loaded with the next reel, ready to switch on.

Most projectors have a warning signal to tell the operator that the reel is coming to an end. The signal device, inside the upper magazine, is a metal arm that drops and rings a bell. At the signal, the projectionist warms up the second projector and checks the carbon arc through the viewer. Then he watches the upper right-hand corner of the screen for the appearance of a tiny dot against a light background or a white circle against a dark background. This is his signal to start the motor on the second projector; but he does not open it for projecting pictures until he sees a second dot. Then he simultaneously switches off the first projector and opens the second. His final job is to remove the film from the lower magazine and rewind it so that the first frames are on the outside of the roll, ready to be shown again.

The pictures on these two pages show how the film travels from the upper magazine of the projector and through the arc beam for picture projection. The film continues down through the soundhead and finally to the lower magazine.

In the soundhead the sound track starts the electrical pulses that are amplified and sent to speakers behind the screen. These speakers, working much as radio speakers do, turn the electrical pulses back to sound and carry it to the audience. The sound passes through the numerous tiny holes that dot the screen. Two sets of speakers are used. One set issues the low-frequency (bass) sounds; the other, the high-frequency (treble) sounds. The two sets are placed close together, and the sounds are mixed before they reach the audience.

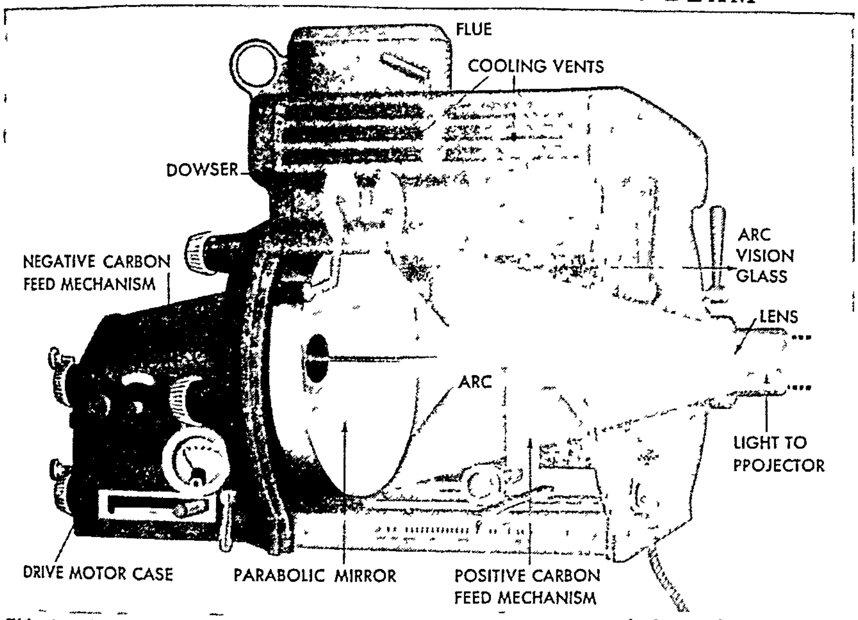
The volume of sound can be adjusted by the operator in his booth or by the theater manager from a downstairs control panel. More volume is needed as the auditorium fills up, because the clothes and even the bodies of people absorb part of the sound. A "full house" can absorb as much as 30 per cent of the sound volume.

Toward More Enjoyable Movie Showings

Research goes forward constantly to improve the quality of pictures and sound. Hotter arc lamps for sharper, brighter pictures are being developed, along with improved cooling flues and vents. Already experimental use has been made of speakers located around the auditorium as well as behind the screen. This battery of speakers brings a flood of sound from all sides, and the full range of orchestral tones is heard without distortion.

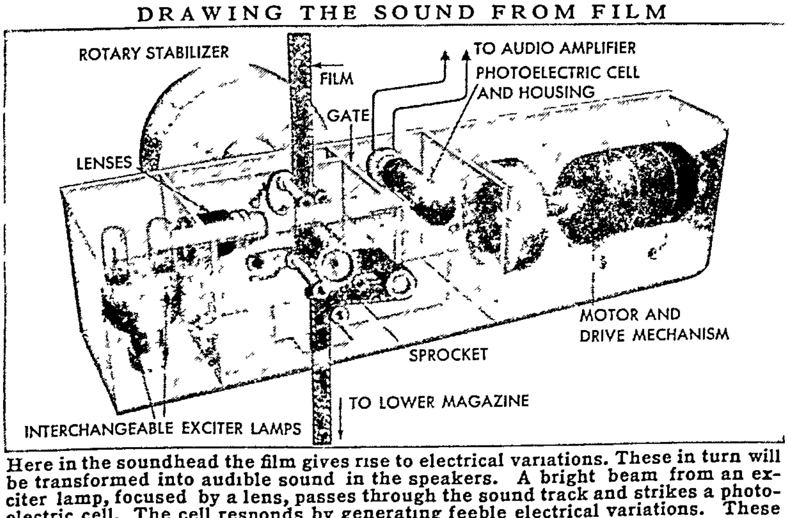
In *drive-in* theaters, patrons can sit in their cars and enjoy a complete movie program. The theater consists of a large screen *tower* at one end of an open field and a smaller structure housing the projector at the other end. Standard projection equipment is used. Sound comes from speakers in the tower or from individual speakers placed in the cars. The cars are parked on inclined ramps raised toward the screen.

HOW THE ARC LAMP THROWS A BEAM



This drawing shows how the bright light from a carbon arc lamp is focused into a beam for projecting pictures onto the movie screen. The article on Electric Light tells how the positive and negative carbon electrodes generate the light itself. The electrodes are adjusted by the feed mechanisms and the heat is carried off through the flue and cooling vents. The light passes *back* from the point where the arc is formed to a parabolic mirror. The mirror concentrates the light and reflects it *forward* to the lens for focusing. The dowser is used when desired as a gate to block the light.

DRAWING THE SOUND FROM FILM



Here in the soundhead the film gives rise to electrical variations. These in turn will be transformed into audible sound in the speakers. A bright beam from an exciter lamp, focused by a lens, passes through the sound track and strikes a photoelectric cell. The cell responds by generating feeble electrical variations. These go to the audio amplifiers for strengthening, then to the speakers behind the movie screen. The oil-filled rotary stabilizer filters out small variations in the speed of the film as it passes through the beam. If one exciter lamp burns out, the operator can immediately pivot the other into position.

How Animated Cartoons Are Made

FOR many people the most enjoyable part of the movie program is the animated cartoon. The fun-filled cartoon provides a refreshing addition to a more serious feature picture. Mickey Mouse, Pluto, Bugs Bunny, Porky Pig and others are loved by children and grownups alike. Although the characters have the bodies of animals, they are delightfully human in their traits. They wear clothes and gently mimic human actions and manners. Many animated cartoons are made in separate departments of the major picture studios. The largest company, Walt Disney Productions, is an independent studio that specializes in short and feature-length cartoons.

An earlier section of this article explained how the movements of living actors are recorded on film. The camera catches them in motion and films each split-second part of a walk or gesture, frame by frame. The cartoon producers cannot photograph moving figures. They must make a separate drawing or painting for each bit of action. Then the painting is photographed, and each photograph becomes a single frame on the picture track. The average short cartoon contains about 45,000 frames, so the same number of separate paintings are needed.

How the Cartoon Begins

Like other movies, the animated cartoon begins with a story. The cartoon story, however, is not written in words. It grows out of a series of action sketches, drawn by a story artist with colored pencils. When the story is worked out in sketch form, the director and his staff begin to make the picture. The staff consists of layout men, background artists, musicians, actors (who provide speech for the characters), and animators.

First the background artists make drawings that show only the sets (backgrounds). Then all the dialogue is recorded. Sound effects and music are recorded after the pictures are drawn.

This matching is accomplished by a careful analysis of the sound track. A chart of the sound track is prepared showing how many frames it takes for a character to speak a word or phrase. The words, "hey, Mickey!" for example, may extend over twelve frames. The animator then makes twelve drawings in sequence, showing the character's lips moving to form the words. The chart also shows the length of vowel and consonant sounds, breathing spaces, and intervals between words.

The Comic Hand of the Animator

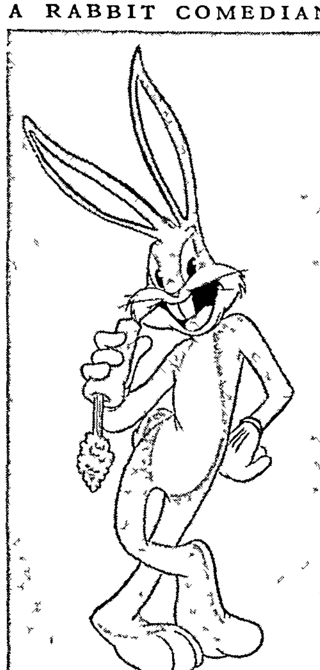
The animator draws the major stages of action himself. He must not only be a good artist but he must also be an actor at heart and have the gift of comic exaggeration. Under him work assistants and "in-betweeners." These artists follow the course of action he has laid out and fill in the finely graded details.

The animators work on a transparent drawing board, illuminated from below. As they complete one drawing, they lay a second sheet of paper on top and vary the new drawing just enough to make the movement easy and natural. The completed series of drawings is filmed as a *rough test* to see that the action flows smoothly.

After the rough test is approved by the producer and director, the drawings are sent to the inking and painting department. Here women transfer the drawings to sheets of celluloid (called *cels*) by outlining the characters in ink. Other women apply paints in various colors to the reverse side of the cels, allowing the inked outlines to remain clear. These paints are ground and mixed in the studio laboratories from special formulas. More than 750 colors and shades are used.

Finally the cels are sent to the camera department. The pictures of the characters are laid over the proper backgrounds and photographed. For a scene that includes several characters, four or more cels of action may be required to produce a single frame of film.

A RABBIT COMEDIAN



Bugs Bunny, Star of Warner Bros. Cartoons

Typical of animated cartoon characters is Bugs Bunny. The trademark of this comic rabbit is a half-nibbled carrot and a saucy remark, "What's up, Doc?"

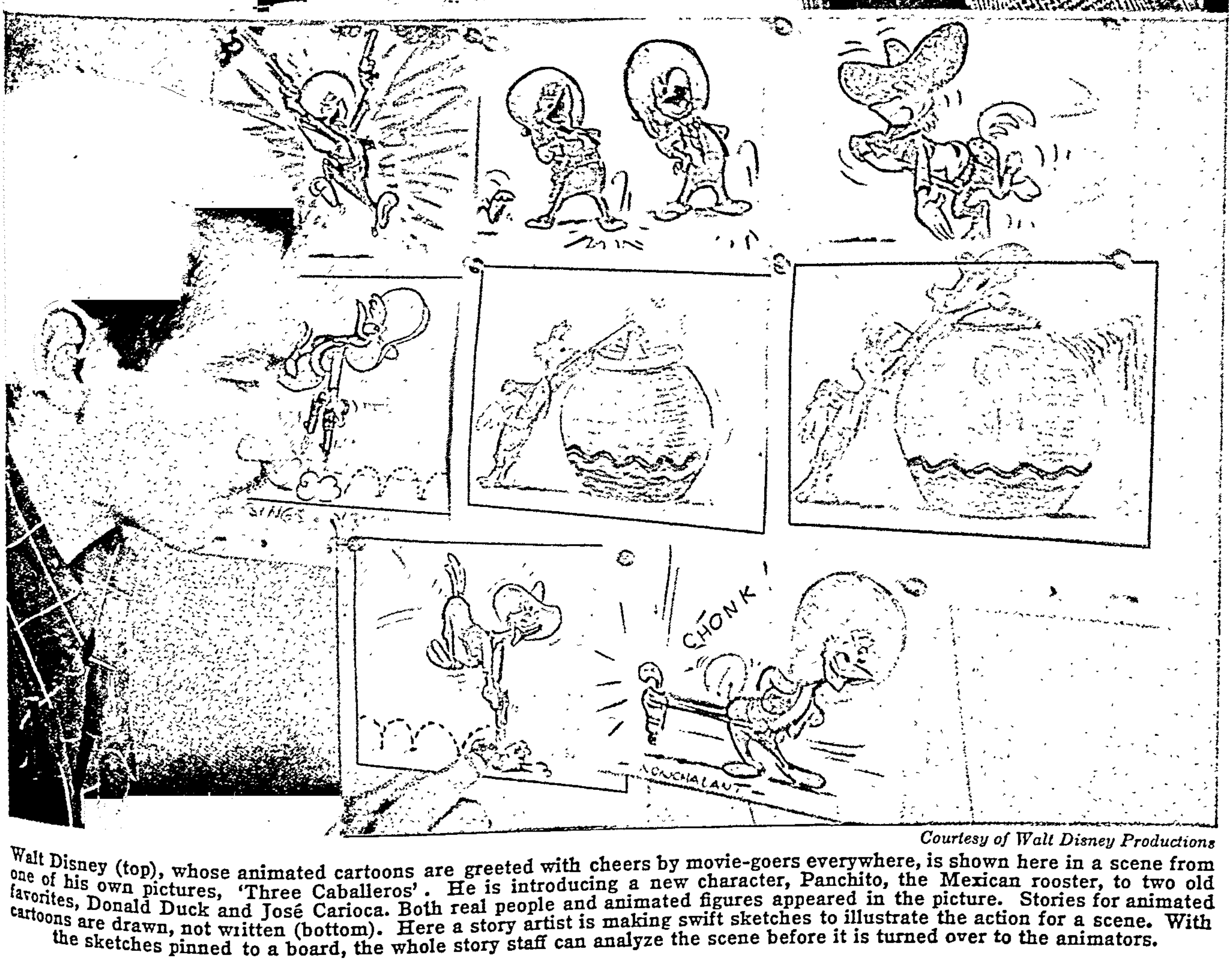
With ordinary photographic methods, the frame shows only the perspective or depth put into the original drawings by the artist. The multiplane camera, however, eliminates much of this "flatness." This camera shoots straight down from the top of a high structure. Directly below the lens, at various levels, are stacked the character cels and the different elements of the background painted on special glass plates. Each level can be lighted and moved separately. The result on the screen is an illusion of a three-dimensional picture.

Cartoon Dolls and Puppets

A newer phase of animated cartoon production is the art of photographing plastic dolls or puppets against a three-dimensional background. With puppets manipulated by almost invisible strings, the problem of filming is much the same as in photographing real actors on a studio set (*see* Puppets). But the dolls must be filmed by the same frame-by-frame methods used for animated cartoons. The background and props must be set and the doll characters placed in a new degree of position for each frame of film.

Each doll has more than a hundred detachable heads, painted with various stages of expression. Also kept ready are hundreds of detachable hands, arms,

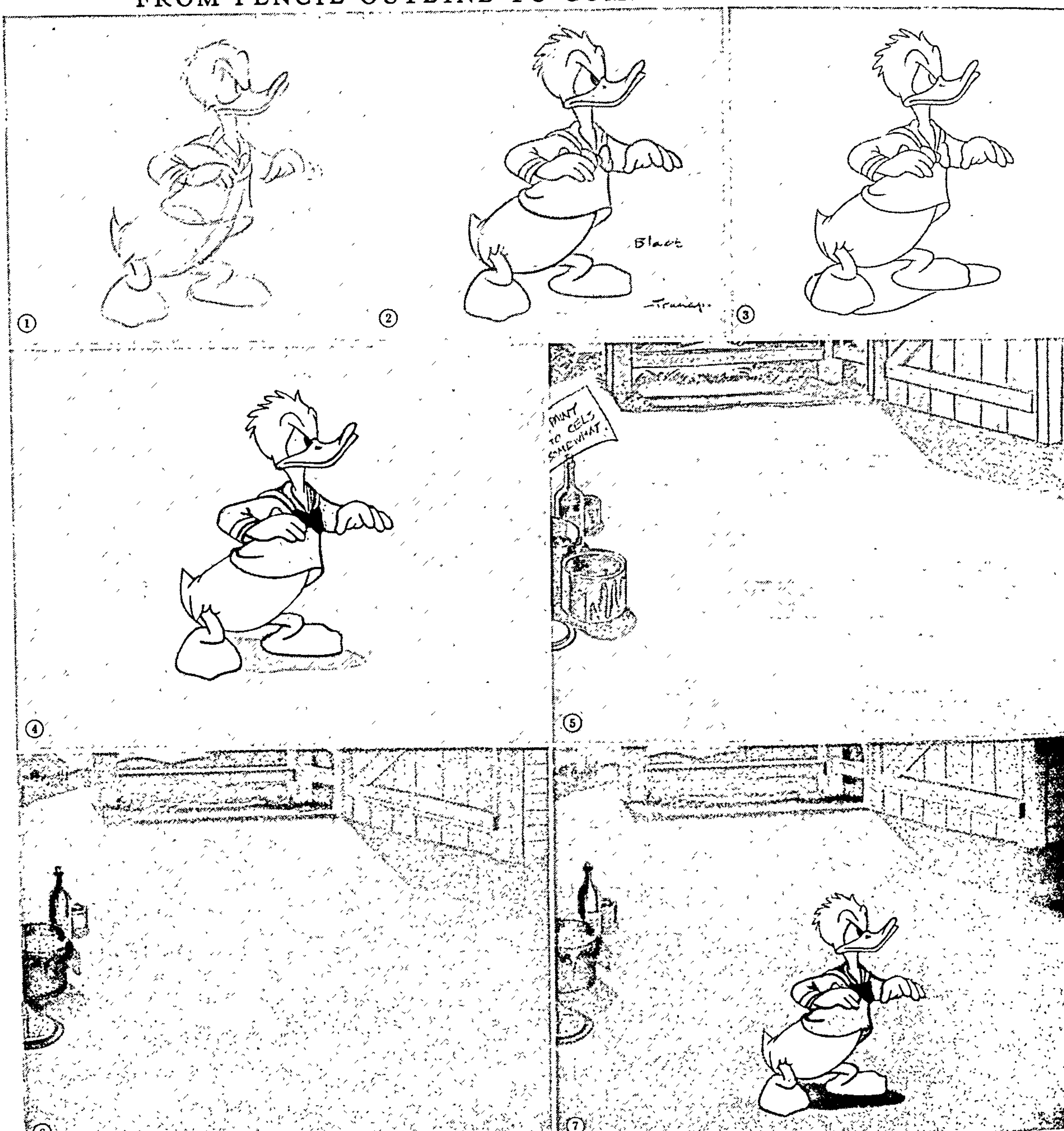
WALT DISNEY AND HIS DELIGHTFUL CHARACTERS



Courtesy of Walt Disney Productions

Walt Disney (top), whose animated cartoons are greeted with cheers by movie-goers everywhere, is shown here in a scene from one of his own pictures, 'Three Caballeros'. He is introducing a new character, Panchito, the Mexican rooster, to two old favorites, Donald Duck and José Carioca. Both real people and animated figures appeared in the picture. Stories for animated cartoons are drawn, not written (bottom). Here a story artist is making swift sketches to illustrate the action for a scene. With the sketches pinned to a board, the whole story staff can analyze the scene before it is turned over to the animators.

FROM PENCIL OUTLINE TO COMPLETE COLOR FRAME



Courtesy of Walt Disney Productions

To make a *cel*, or foreground painting on celluloid, an animator first makes a rough pencil outline of the figure (1). From this, another artist makes a "cleaned-up" pencil drawing (2), which is copied on celluloid in ink (3). The cel is turned over, and technicians fill in the color on the back (4). For the background, an artist makes a pencil sketch (5) and then a color painting (6). Finally (7) the cel is laid on top of the background and photographed. Even a simple movement needs dozens of cels, all different, for the figure. The same background, however, can serve until the character moves to a different location.

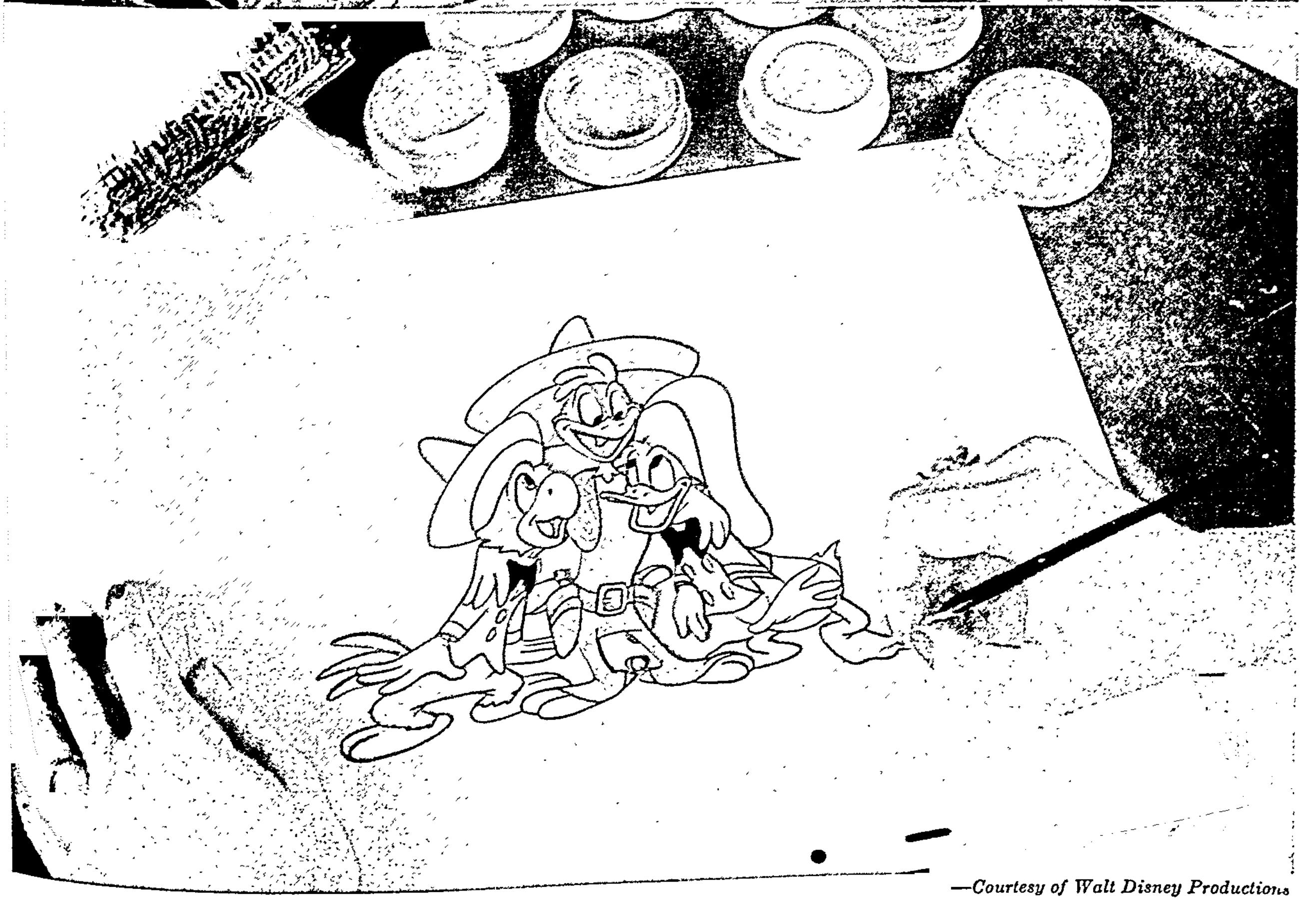
legs, and feet for each change of body movement. Each figure goes through about eight changes of motion in taking one step. The doll is held in place by a steel pin during each stage of motion as the frame is filmed. The figures are about six inches tall, and the sets are scaled down in proportion.

Cartoons as Educational Aids

Most of the animated cartoons are produced for entertainment. An increasing number, however, are being made for training purposes, for use in schools, industries, and the armed forces. These are made both in Hollywood and in studios all over the country, which specialize in this type of work.

In the second World War, black-and-white and color cartoons were used to teach such varied subjects as rifle maintenance and basic understanding of global war. Some pictures used familiar cartoon characters; others used purely diagrammatic treatment.

HOW BACKGROUND AND FIGURES ARE PAINTED



—*Courtesy of Walt Disney Productions*

An artist (top) is finishing a water-color background that will be used for a whole sequence. His inks and paints are made in the studio with special formulas. A technician (bottom) is coloring the back of an inked cel of José Carioca, Panchito, and Donald Duck. This is but one of several hundred cels that will show the three singing a song. Their gestures and the movements of their mouths correspond to a musical score recorded in advance. Notice how the inked outline shows through on the color side of the cel. The colors must match exactly from cel to cel, so that the sequence will run smoothly on the screen.

Motion Pictures in Commerce and Trade

MOVIES reach the local theaters through a system of distribution *exchanges* located in 32 cities across the United States. These exchanges serve more than 18,000 theaters. The theater owner or manager, called the *exhibitor*, periodically visits the exchanges nearest him and views the available pictures. He selects the movies he wants for certain dates of exhibition and arranges for payment either on a flat rental basis or on a percentage of the box office receipts.

The exhibitor chooses the pictures that are most likely to appeal to the audiences in his community. These audience standards vary widely in different places, and the exhibitor knows that it is good business to please his patrons. Some movies are popular all over the country; others are liked only by certain groups or ages of spectators.

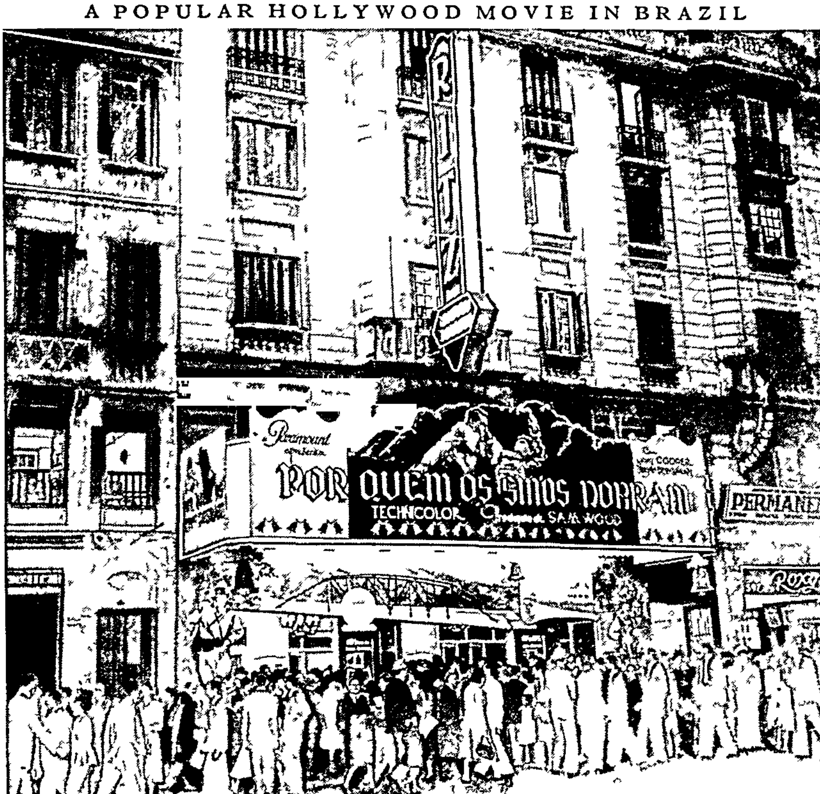
Movies Are "Big Business"

Every day millions of people "go to the movies" in the United States. Most of them attend regular motion-picture theaters, but many see films as part of schoolwork, as on-the-job training in civilian or military work or as part of an organization meeting program. Television makes regular use of motion pictures, either those originally intended for theaters or those made directly for television showings (*see* Television). All these uses have built the motion-picture business into one of America's largest industries. Studios, exchanges, theaters, and television networks owned by movie companies are valued at several billion dollars.

The three groups that make, distribute, and exhibit the movies each get a proportionate share of the movie patron's dollar. (These proportionate allotments of the consumer's dollar represent very rough averages, based on studies made of the movie industry over several years.) Excluding federal, local, and other taxes based on box-office receipts, the exhibitor keeps about 68 cents of each dollar received at the box office. He pays the 32 cents to the distributor as rent on the film. (This 32-cent rent is an average fee. Rental on a "first-run" picture may run as high as 65 cents from each box-office dollar.) The distributor keeps about 12 of the 32 cents and pays the remaining 20 cents to the studio (the "manufacturer"). Each of these draws a normal business profit from his share and pays required income taxes on it.

From his share of 68 cents of the dollar, the exhibitor spends about 16 cents on salaries to theater employees, about 15 cents on rent or its equivalent, and about 20 cents on other operating expenses. The distributor spends most of his 12 cents on making additional positive prints, advertising, operating the exchange, and delivering films to the theaters.

A POPULAR HOLLYWOOD MOVIE IN BRAZIL



Typical of motion-picture theaters in foreign lands is the Ritz Theater in São Paulo, Brazil. Here it is showing 'Por Quem Os Sinos Dobram', a Portuguese-language version of 'For Whom the Bell Tolls'. American pictures are often shown for years after they have finished their run in the United States. Because of curtailed shipments during the second World War, showing of American films in foreign countries lagged for several years.

The studio spends about one cent of its share of 20 cents for the story and screen play, and the same amount on the producer and director. About seven cents goes for settings, properties, camera and sound operations, music, make-up, and wardrobes. The actors get about four cents in salaries, and another four cents is set aside for what businessmen call "overhead."

The Foreign Market

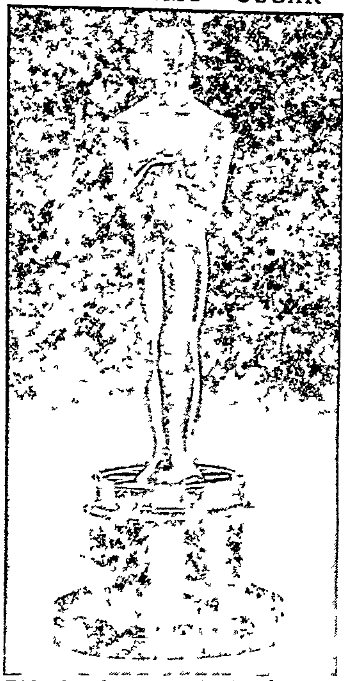
American studios get approximately 70 per cent of their income from theaters in the United States and Canada and 30 per cent from theaters in other countries in the world. These foreign theaters, numbering about 68,000, serve an estimated 145 million patrons each week. Many of their films are American-made, and Hollywood production costs are based in part on the anticipation of this foreign revenue. If, for one of the many reasons that arise during changing world conditions, American pictures are banned in a foreign country, the studios suffer serious financial losses.

Special versions of American pictures are prepared for countries

where English is not spoken. The picture remains the same, but a new sound track is substituted. This contains a translation of the dialogue, cleverly arranged to appear as though it were actually being spoken by the actors in the picture. Sometimes the English language sound track is left intact, and a brief printed translation into the foreign tongue is superimposed on the picture itself. In a few cases, especially for the huge Latin-American market, Hollywood actors popular in those countries have learned Spanish and make regular Spanish-dialogue productions.

Many foreign countries have flourishing motion-picture industries of their own, and their best productions rival, and sometimes surpass, the finest Hollywood pictures. Britain, France, Russia, Sweden, and Italy each have a large movie output annually, as do Germany and Japan in normal years. India makes more than a hundred pictures yearly, with sound tracks in many native dialects. British motion pictures are shown extensively in the United States; other imported films are popular in American cities with large foreign-born populations.

THE ACADEMY "OSCAR"



This handsome statuette is presented annually to winners for outstanding work by the Academy of Motion Picture Arts and Sciences. It is ten inches high, and is of cast bronze plated with gold.

The Academy and Its Awards

The Academy of Motion Picture Arts and Sciences is an honorary service organization of craftsmen, artists, and technicians who have made outstanding contributions. Members are divided into 12 branches: actors, art directors, cinematographers, directors, executives, film editors, musicians, production, public relations, short subjects, sound, and writers.

Organized in 1927, the Academy keeps the official records and screen credits for the industry. It maintains a large library of books, magazines, and historic films, as well as its own theater. It also cooperates with education institutes and serves as a general liaison agency in the field of motion pictures.

The Academy is best known to the public for its annual presentation of awards for the best motion-picture work of the year. Academy awards are made on the basis of professional excellence and have no relation to box-office rating or popularity polls. The award statuette is familiarly known as "Oscar." Each year 26 awards are presented in the following classifications: acting, art direction, cinematography, directing, film editing, music, production, short subjects, sound recording, special effects, and writing. Special awards may be conferred by the Academy Board of Governors for outstanding achievements not strictly within these categories.

Nominations for awards are made by vote by the Academy branches. After the results of the nominations balloting are known, the Academy screens each of the nominated pictures in its own theater to give members a chance to see all candidates under the same conditions. The final votes of all members determine the award winners.

Standards and Censorship

Motion pictures have a far-reaching effect on the lives of many in the vast audience of movie-goers. The ways of living presented by this vivid medium are convincing and believable, especially to children and impressionable young people. The movie industry therefore has a great responsibility in seeing that only acceptable ideals are shown on the screen. A set of regulations, called the Production Code, helps the studios to avoid objectionable stories or scenes. The regulations are put into effect by the Production Code Administration of the Motion Picture Producers and Distributors of America, an association of the major studios and theater owners. The studios submit screen plays before filming for guidance and approval. Acceptable pictures show a "seal of approval" in the screen credits section at the beginning of the movie.

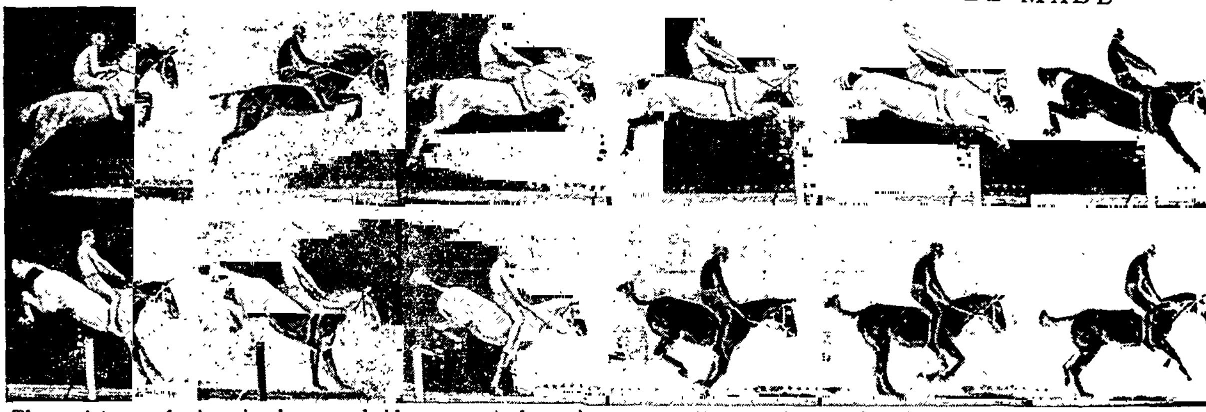
Several states and cities have censorship boards that review movies before they are shown in their localities. These boards can cut out what they consider objectionable or ban the picture entirely. Another reviewing board is the National Legion of Decency, an agency of the Roman Catholic church in the United States. This board puts films into four classes: for the whole family, for adults only, objectionable in part, and condemned. The Protestant Motion Picture Council makes similar reports to its church members.

From Pioneer Days to Now in Movie Making

THE POSSIBILITY of making pictures *move* was first investigated by Peter Mark Roget in 1824. His paper 'Persistence of Vision with Regard to Moving Objects' laid a foundation for all further work. During the next several decades, experimenters built various wheels that flashed a set of crude drawings before an eyepiece to produce the illusion of motion. Some of them are shown in the picture on the next page. These remained little more than interesting toys, and no further progress was made until photography was in common use.

In 1872 Leland Stanford, a wealthy Californian, engaged Eadweard Muybridge and John D. Isaacs to help settle a wager over the gaits of running horses. To produce the winning evidence, the men set up 24 cameras with electric shutter controls in a row along a track. The horse hit trip strings as it ran, and exposed each plate in turn, thus recording each movement.

PICTURES THAT SHOWED HOW MOVIES COULD BE MADE



These pictures of a jumping horse and rider are part of a series taken by Eadweard Muybridge in 1883. Each picture was taken by a separate camera. Muybridge's photography experiments demonstrated how still pictures like these could suggest movement.

They took several series of pictures of running horses. One set is shown at the top of the page.

Later Muybridge's pictures were shown in rapid succession on a screen in a kind of magic-lantern projector. The method of picture taking was improved when W. G. Levison, of Brooklyn, N. Y. invented a camera that could rapidly expose a number of plates.

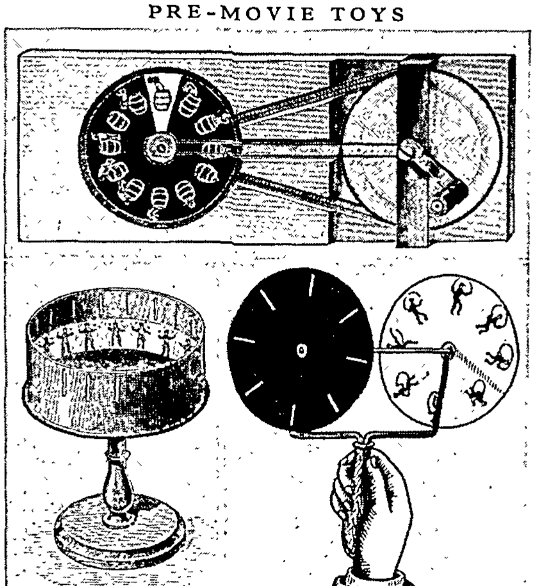
Edison's Contributions

In 1887 Thomas A. Edison began experimenting with motion pictures (*see* Edison). He abandoned the individual glass plates and searched for a strip of tape that could record a long series of pictures. In 1889 George Eastman began manufacturing film on a flexible nitrocellulose base. Edison found this material suitable because it could be exposed in sections and it could be swiftly reeled and unreeled for use in a camera or a projector.

Edison called his projector a *kinetoscope*. It was a "peep-show" cabinet with an eye-piece on top. Only one person at a time could see the show inside. The film, wound on rollers, was about 50 feet long, and the show lasted for only 13 seconds.

The forerunner of the modern projector was Thomas Armat's *vitascope*. This was the first projector to use the intermittent motion, now standard. The vitascope was first used in Koster and Bial's music hall in New York City, April 23, 1896. For many years after, the movie was one feature on a vaudeville program. The picture lasted only a few minutes, about the same time as a vaudeville act. The subjects were very simple—waves crashing against rocks, a few moments of a prize fight, or a simple dance. The novelty soon wore off, and audiences began to demand longer and more interesting pictures.

PRE-MOVIE TOYS



Toys like these delighted people before modern motion pictures were invented. They all employed persistence of vision. At the top is a *zoetrope* or "wheel of life." It showed a man jumping in and out of a barrel. In the bottom picture (left) is another form of a zoëtrope. The *phenakistoscope* ("deceiver-scope") at the lower right showed a man jumping rope.

The Industry Grows

In 1903 Edwin S. Porter, an Edison cameraman, combined several exciting action scenes into a movie called 'Life of an American Fireman.' He followed this with the first story in motion picture form, 'The Great Train Robbery.' Both of these were very short, but people were willing to pay to see them without the vaudeville. The first movie theater was opened in Los Angeles in 1902; and soon thousands more sprang up all over the country. They were called *nickelodeons*, a name coined from their five-cent admission and from the Greek word meaning "theater."

Studios were established in New York and Chicago. But seeking more varied scenery and greater sunlight, movie companies soon moved westward to California. In 1907 William Selig rented a Los Angeles building for a studio and in 1911 built the first permanent studio in that city. Pictures were made the same year in Hollywood.

With the new pictures came improved methods of photography and direction. In 1907 David Wark Griffith introduced the close-up, the fade-out, and intercutting. Griffith's great achievement was 'Birth of a Nation' (1915), a picture that set a high standard for many years. George Melies, of Paris, added methods for dissolves and double exposures (1909). These techniques turned movies from mere photographic records into dramatic stories for the screen.

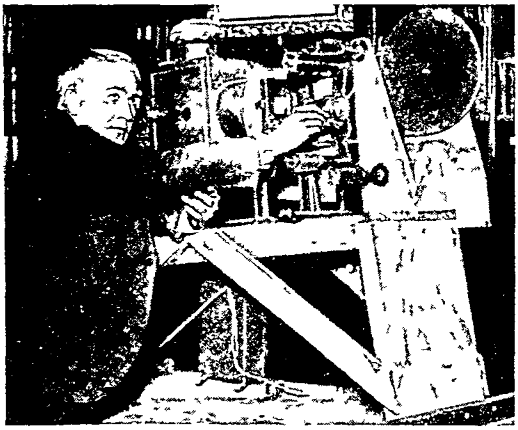
Sound Revolutionizes the Industry

Until 1926 all movies were "silent." The actors merely

SCREEN FAVORITES OF THE EARLY DAYS

1. Western fans cheered when William S. Hart came on the screen. Here in double exposure he plays both hero and villain. 2. The Keystone Kops delighted lovers of boisterous comedy. Ford Sterling is the chief at the telephone. 3. Mary Pickford, portrayer of pathetic child rôles, was a reigning star and "America's sweetheart" for many years. 4. 'Birth of a Nation' had many thrilling battle scenes, including this one with Henry B. Walthall as a Confederate colonel. 5. Marie Dressler and Wallace Beery were loved for their 'Min and Bill' rôles. 6. Harold Lloyd played many parts as a likable young man in trouble.

EDISON'S EARLY PROJECTOR, AND AN EPOCH-MAKING MOVIE



Among Edison's notable developments was a workable motion-picture projector. His movie research was conducted in a tar-paper shack studio at West Orange, N. J. At the right is a scene from 'The Great Train Robbery', made in 1903. This movie was one of the first to tell a real story on the screen.

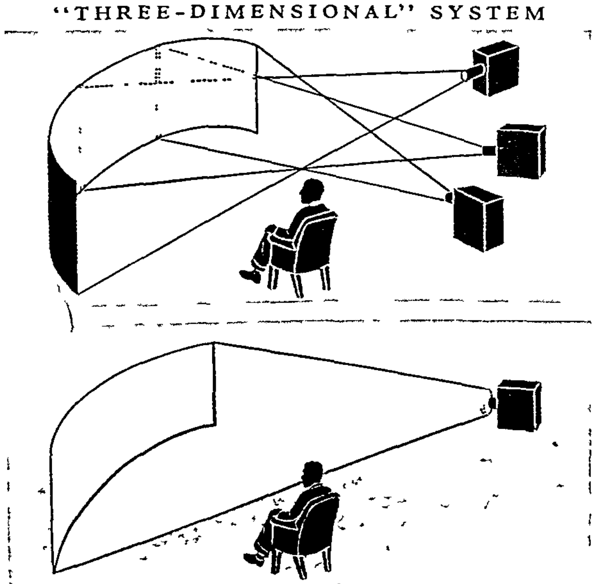
moved their lips, and a summary of what they were supposed to be saying appeared, lettered on separate picture frames.

Working with electron tubes designed for radio, inventors learned to record sound along with the pictures. The first movie to use sound (a musical score recorded on disks) was 'Don Juan' (1926). The first movie with any dialogue in sound was 'The Jazz Singer' (1927). Synchronizing disk records with pictures was difficult; the disks were soon replaced by film sound tracks.

Sound brought amazing realism as well as new problems to the movies. Actors with unpleasant voices lost favor and were replaced. Stories, once told almost completely by pictures alone, had to be written with speeches for each player. Music and sound effects required new editing techniques. Cameras and set equipment were soundproofed; sound stages were erected to enclose sets. Sound projection equipment was installed in the theaters.

In 1952 so-called three-dimensional movies were shown to public audiences. One "3-D" process was based on the stereoscope principle and required the use of special glasses (*see* Stereoscope). *Cinerama*, invented by Fred Waller, required three cameras, a curved screen, and a "stereophonic" system of sound recording and projection. *CinemaScope*, invented by Henri Chretien, used one camera with wide-angle lens to "pack in" the image on the film and a special projector lens to spread the image out again. In 1954 experiments were successful with an electronic camera that recorded movies on tape instead of film. (*See* table of motion-picture terms in Fact-Index.)

"THREE-DIMENSIONAL" SYSTEM



In Cinerama, top diagram, one panoramic image is transmitted in three blending sections by three projectors. CinemaScope, bottom, uses one central projector with a wide-angle lens.

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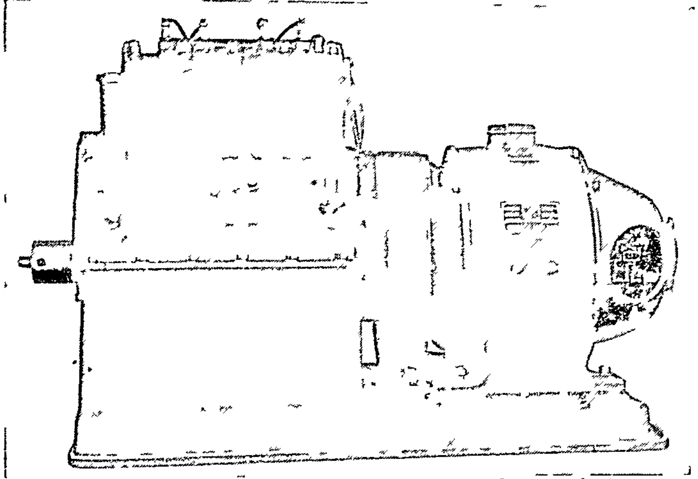
COMPACT *and* HARD-WORKING MOTORS

MOTOR. Most of the world's hard work is done by motors and engines. Electric motors harness the energy in an electric current. Many motors use the power of compressed air in pneumatic devices. Steam engines are widely used for heavy work loads. Internal combustion engines are most commonly used for tasks which require a cheap, light, and efficient power unit.

There is no clear-cut distinction between the terms "motor" and "engine." Each one converts energy into mechanical power. But the term "motor" is usually applied to the electric motor and to smaller internal combustion engines such as the outboard motor. The electric motor is substantially an electric generator run in reverse, so both are treated in the article on Electric Generator and Motor. Larger internal combustion engines are treated in the articles on Automobile and Diesel Engine. This article deals with the smaller internal combustion motor and how it works.

MOTOR POWER FOR GENERATING ELECTRICITY

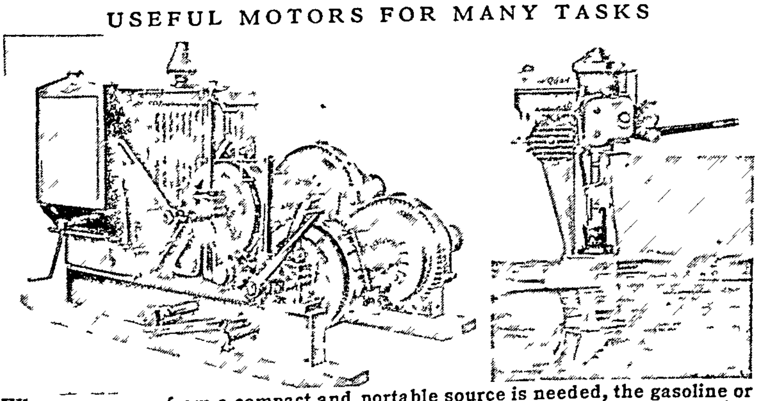


This is a small four-cylinder gasoline motor coupled to an electric generator. These plants are widely used on farms and yachts.

Advantages of the Small Motor

If a steam or Diesel engine could be reduced in size and weight, it might compete with the small internal combustion motor. But both these engines require extremely heavy boilers or cylinders and cannot be built very much smaller than present models. An electric motor is highly useful, but it must be connected to a stationary source of electric power or to a storage battery, which runs down after a time and must be recharged. But an internal combustion engine carries its own fuel in a tank. The whole arrangement is small and portable, and the tank can be refilled without stopping the motor.

USEFUL MOTORS FOR MANY TASKS



Wherever power from a compact and portable source is needed, the gasoline or Diesel engine is used. The portable hoisting rig (left) is used in construction work for running material elevators and other hoisting work. The convenient outboard motor (right) turns a rowboat into a swift craft.

Thus the small internal combustion motor finds wide use on light vehicles such as motorcycles and boats. It can be used to provide power for washing machines, pumps, electric generators, farm machinery, and for similar purposes. In many parts of the West motor-driven pumps supply reservoir water for irrigation or for watering cattle. A man visits them perhaps once a day to refill the fuel tanks, and the rest of the time they chug away unattended.

How the Motor Works

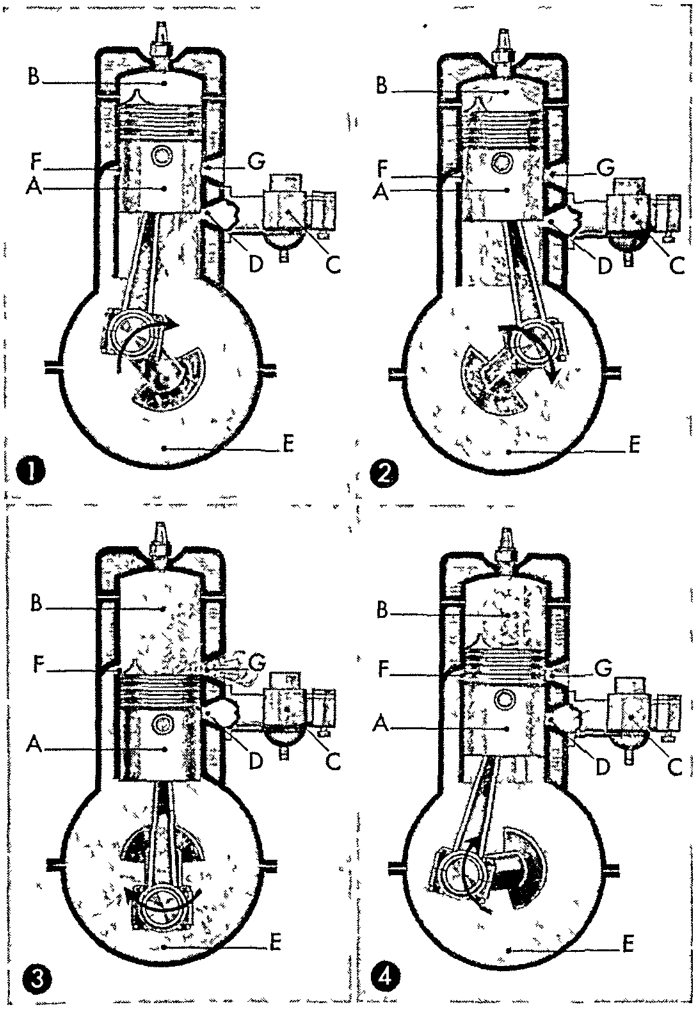
These motors can be operated on almost any explosive gas or any liquid which will yield such a gas. For this reason it is sometimes called a *gas* motor. The gas burns with explosive force inside a confined chamber; hence the name *internal combustion* (*see* Internal Combustion Engine). Gases which have been used include natural (petroleum) gas, acetylene, propane, and butane. Liquid fuels from which gases are formed include kerosene, alcohol, and various derivatives of petroleum. But by far the majority of gas motors use gasoline.

In its simplest form the gas motor operates on the cylinder and piston principle. The piston slides back and forth in the cylinder chamber and is joined to a crankshaft (power shaft) by a connecting rod. On the shaft is a heavy flywheel. The momentum of the flywheel keeps the shaft rotating evenly once it has started, and the shaft turns gears or wheels.

The piston movement may be in a *two-stroke* or a *four-stroke* cycle. This simply means that in the first, one of two strokes (up or down movements) is a power stroke—that is, it actually transmits power to the crankshaft. In the second, one of four strokes is a power stroke. The four-stroke cycle forms the basis for the Otto gasoline engine, the principal engine used in motorcars (*see* Automobile).

In a two-stroke cycle gas motor, the piston moves upward to compress gas into a small space at the top of the cylinder. At the top of this stroke the compression is highest. Here an electric spark explodes the gas. The swiftly burning gas expands violently and pushes the piston down to the other end of the

HOW THE TWO-STROKE CYCLE WORKS



Here are the four steps in the two-stroke cycle. 1 The piston (A) rises in the firing chamber (B) and provides more space in the crankcase (E). The gas mixture is drawn into the crankcase from the carburetor (C) through the intake port (D). 2. The gas in the firing chamber explodes and drives the piston down. After the piston passes the intake port, it compresses the gas in the crankcase. 3. The end of the power stroke uncovers the transfer port (F). The compressed gas in the crankcase expands into the firing chamber. Meanwhile the burned gas has escaped through the exhaust port (G). 4 The new gas in the firing chamber is being compressed for the next power stroke.

cylinder. This down stroke is the power stroke. As the piston nears the end of the power stroke, the burned gases are exhausted from the cylinder and new gas rushes in, ready to be compressed in the upstroke.

When gasoline is used, a carburetor is needed to turn the liquid gasoline into a vapor and to mix it with air to form the explosive gas. The carburetor uses a suction force set up by the piston. It draws air through a narrow passageway at tremendous speed. The air rushes through a needle valve containing gasoline and breaks it into a fine spray. This mixes with the air and enters the cylinder as a gas. The carburetor provides a mixture of about 15 parts of air to one part of gasoline. This proportion may be varied by a choke control to provide a mixture richer in gasoline for starting a cold motor.

The gas is ignited by a spark plug screwed into the cylinder head. The spark plug has a porcelain core enclosing a wire electrode. A metal shell around the porcelain core holds a second wire. This is separated from the center wire by a space of about $\frac{1}{32}$ of an inch. An electric current leading from a storage battery to the center wire of the spark plug "jumps" the gap between the wires and returns to the battery through the metal frame of the motor. As the current "jumps" it forms a spark and ignites the gasoline and air mixture in the cylinder.

Only very small motors operate on a single cylinder. Others range from two-cylinder to four-, six-, eight-, twelve-, and sixteen-cylinder motors. The cylinders are timed to fire one after the other so that a smooth and continuous power drive is achieved.

In two-cylinder motors the cylinders are timed so that one of them explodes at each revolution of the crankshaft. If there are four cylinders, one of them explodes at each half-revolution, and so on for added cylinders The timing of explosions is accomplished by a camshaft connected to the crankshaft by gears. The cams on this shaft open and close the cylinder valves at continuous intervals.

Other Types of Gas Motors

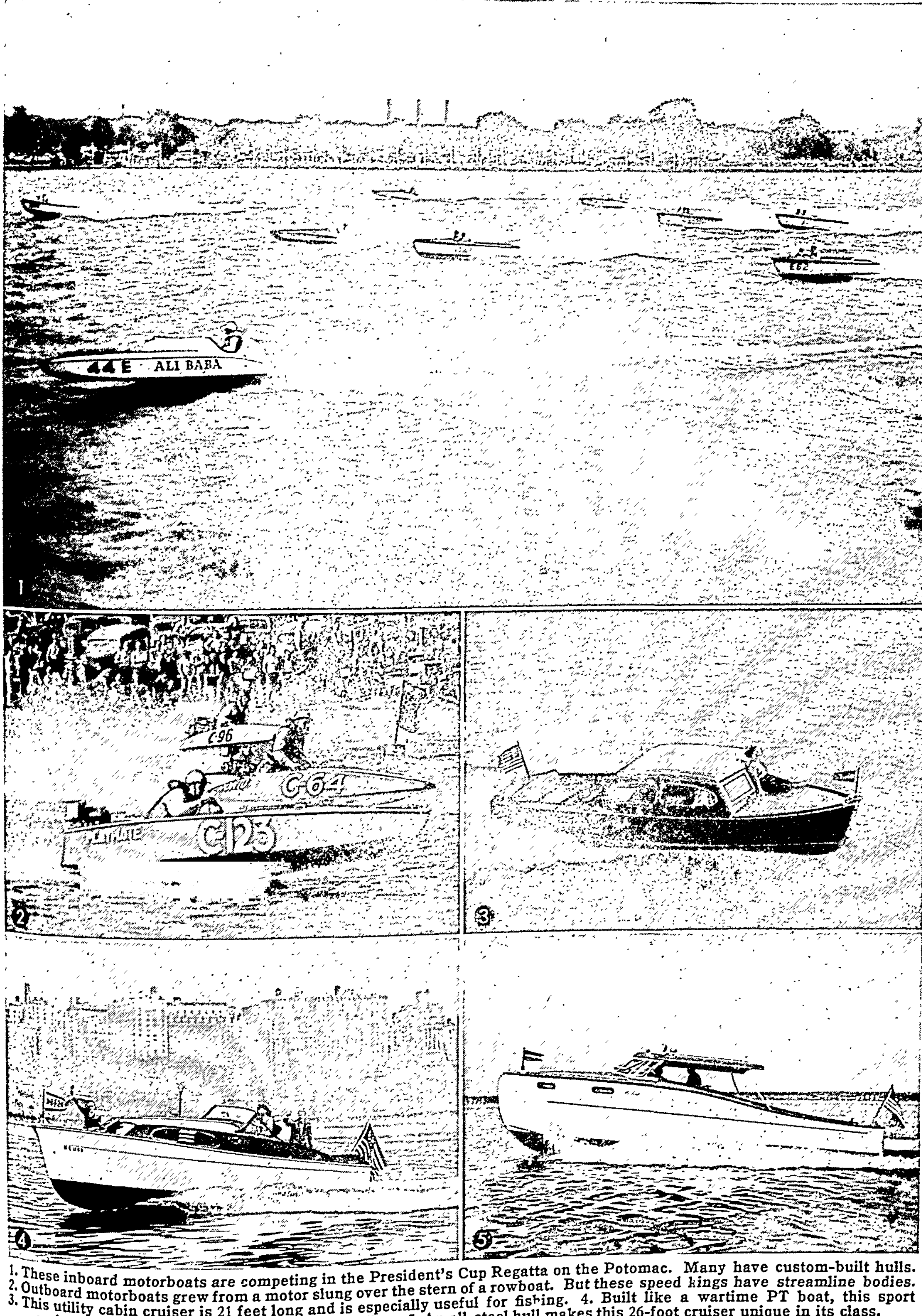
Internal combustion motors may drive a piston in a cylinder or they may provide power by *reaction*. The reaction principle is used in jet propulsion. The simplest type of jet motor, the ram jet, works by letting the expanding gas react or push against the motor and so drive the jet device (*see* Jet Propulsion).

The gas turbine is another reaction motor. The expanding gases turn the vanes of a turbine and these turn the crankshaft. In some gas turbines the power shaft rotates wheels or a propeller. In the turbo-jet motor, the power shaft turns an air compressor.

MOTORBOATS. The motorboat like the motor car was made possible by the gas engine. The changes it made in water transportation were almost as great as those caused on land by the automobile. Steamships still bear the biggest share of water traffic, just as railways still carry the most land freight. The service rendered by motorboats may be likened to that of trucks, busses, and passenger cars. These craft, powered by gasoline or Diesel engines, range in size from cargo boats and yachts over a hundred feet long to tiny skiffs and dinghies equipped with midget-size outboard motors (*see* Motor; Ships).

Among the best-known types of motorboats are the speedy runabouts and slower pleasure cruisers which ply the waters of our seacoasts, rivers, and inland lakes during the warm seasons. Almost as well known are the high-powered craft used in motorboat racing, including those with specially designed hulls of the hydroplane type capable of speeds of more than 150 miles an hour on short runs. More numerous and important than the pleasure craft are the motorboats

MOTORBOATS FOR SPEED AND PLEASURE CRUISING



1. These inboard motorboats are competing in the President's Cup Regatta on the Potomac. Many have custom-built hulls. 2. Outboard motorboats grew from a motor slung over the stern of a rowboat. But these speed kings have streamline bodies. 3. This utility cabin cruiser is 21 feet long and is especially useful for fishing. 4. Built like a wartime PT boat, this sport cruiser has berths for four and a complete galley. 5. An all-steel hull makes this 26-foot cruiser unique in its class.

used by commercial fishermen, from the small open boats that work in quiet waters to the big Diesel-powered ships that venture far out to sea. Many of the latter are "motor sailers" equipped with sails as well as engines.

Motorboats have proved their value in warfare as patrol vessels, airplane rescue or "crash" boats, troop-landing craft, submarine chasers, escort vessels, and the motor torpedo boats (MTB's) and patrol torpedo boats (PT's) of the so-called "mosquito fleet." The last are the fastest of all naval vessels, capable of speeds greater than 40 knots. They are from 70 to 80 feet long, built of thin plywood, and powered with three supercharged gasoline engines each of 1,500 horsepower. They carry heavy machine guns and four torpedo tubes. In both Atlantic and Pacific waters during the second World War these vessels proved their ability to dodge forward through heavy gunfire, sink big warships, and escape again with little or no damage to themselves. (*See also* Boats and Boating; Navy.)

MOTT, LUCRETIA COFFIN (1793–1880). For most of her life Lucretia Mott crusaded against slavery and fought for equal rights for women. But her public activity did not keep her from living a long and happy married life. She had six children and took good care of her home and family.

LUCRETIA MOTT

Mrs. Mott devoted her life to fight slavery and to promote women's rights.

Lucretia Mott was born on the island of Nantucket, Mass., on Jan. 3, 1793. Her parents were Quakers. Thomas Coffin, her father, gave up his post as ship's captain in 1803 and moved his family to Boston. There Lucretia attended public school. At 13 she entered a Quaker boarding school in Poughkeepsie, N. Y. Here she met James Mott. They were married in 1811, when Lucretia was 18.

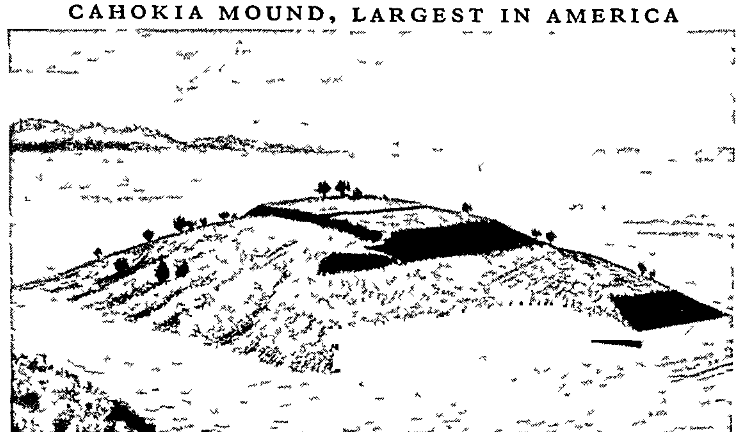
Mott entered Thomas Coffin's manufacturing business in Philadelphia, and Mrs. Mott conducted a small school for a time. The death of her infant son brought Mrs. Mott closer to her church. She began to speak at meetings and soon became an acknowledged minister. When the Quakers split over the slavery question in 1827, the Motts joined the antislavery faction called Hicksites, led by Elias Hicks.

In 1833 Mrs. Mott helped found the American Anti-Slavery Society. In 1840 she attended a world anti-slavery conference as the society's delegate. When the convention refused to seat women delegates, she was fired with the need for action on the women's-rights question. She met Elizabeth Cady Stanton in London, and together they planned a women's-rights convention. It met at Seneca Falls, N. Y., eight years later, and launched the first women suffrage movement in the United States. When the Fugitive Slave Act was passed in 1850, the Mott home in Philadelphia became one of the important stations on the "underground railway." But during the Civil War, Mrs. Mott lived in semiretirement. She hated slavery as deeply as ever, but she was a pacifist and could not approve of the war. She died Nov. 11, 1880.

MOUND BUILDERS. Scattered over the eastern half of the United States, especially in the Mississippi River valley and around the Great Lakes, are great numbers of earth mounds. Many of these are in regular geometrical designs and others are shaped to resemble birds, snakes, bears, and other animals. Once it was widely believed that they had been built by some mysterious "lost race." But archeologists cut into the mounds, examined the skeletons and relics found there, and determined that the builders were prehistoric American Indians.

They used the mounds as burial places, as temple platforms, or for other ceremonial purposes. Most mounds were built between A.D. 500 and 1100. They were deserted and overgrown when first seen by white people. But explorers found later mounds in use.

CAHOKIA MOUND, LARGEST IN AMERICA



The great Cahokia Mound in southwestern Illinois is sometimes called Monk's Mound. Indians of the advanced Middle Mississippi culture built it between 1400 and 1700 as a platform for a temple. Its base covers 16 acres and it rises to a height of 100 feet. This artist's sketch was drawn at the mound site.

The pyramid-shaped temple mounds occur mainly in the lower and middle Mississippi Valley. Wisconsin has the most animal effigy mounds.

Among the most advanced mound builders were those who made the 1,350-foot Great Serpent Mound in Adams County, Ohio, and other huge ceremonial earthworks. The culture of these farming and hunting people has been called "Hopewell culture" by scholars. They had serviceable tools and weapons of flint and other stone, hammered copper, bone, and shell; pot-

tery cooking vessels; and woven fabrics. Carved birds and animals decorated their stone pipes. They wore elaborate ornaments of copper, mica, shell, and fresh-water pearls. They traded with distant tribes—getting copper from the Great Lakes area, mica from North Carolina, and shells from the Gulf coast.

MOUNTAIN ASH. When the early frosts visit the mountain woodlands the berries of this American tree take on a golden-red and join their lavish display to the autumn festival of color. Long after the leaves have fallen away, its acid berries cling to the bare twigs, brightening the snow-clad hills and furnishing food to flocks of birds that winter in the north. The winter buds are very showy and swell to a considerable size before bursting in the spring. In the early spring the crisp shining foliage appears and this is soon followed by dense clusters of small whitish-green flowers which exhale a delicate perfume.

BLOSSOMS AND BERRIES OF THE MOUNTAIN ASH

Top, the mountain ash displays its spring foliage and blossoms. The blossoms and the red autumn berries are shown at the bottom.

The mountain ash does not thrive in the shadow of other trees, preferring the more barren spots of rocky slope or outstanding crag. The beauty of the tree has made it valuable for gardens and parks. Planted in rich soil, with plenty of light and room, the mountain ash will grow a trunk often two feet in diameter with a height of 30 feet.

The varieties of the mountain ash are many. Native American species grow from Canada southward through the Allegheny highlands and westward to the Pacific. Other and very similar species thrive in Europe and Asia. The various species differ mainly in height, size of leaves, and vividness of berry color. The tree is sometimes called "rowan tree" in English-speaking lands.

The mountain ash bears no relation to the common ash. It gains its name from the resemblance of its leaves to those of the ash tree. The scientific name of the American mountain ash is *Sorbus americana;* of the principal European species, *S. aucuparia.* The leaves are compound, alternate, odd-pinnated, bright green above, and pale underneath. The flowers are small and white. The berries are a bright red and about the size of a large pea. The bark is dull brown.

MOUNTAINS. A mountain is often thought of as a peak of land rising to a high level above the surrounding country. But isolated mountains are rare. The peaks are usually but points in long parallel ranges which extend for many miles like folds or tucks in the earth's surface. The loftiest mountains of the world are arranged with remarkable uniformity in two great belts. One constitutes a "world girdle." It surrounds the Pacific Ocean, bordering four of the great continents. The other extends in an east-west direction, sprawling across Eurasia.

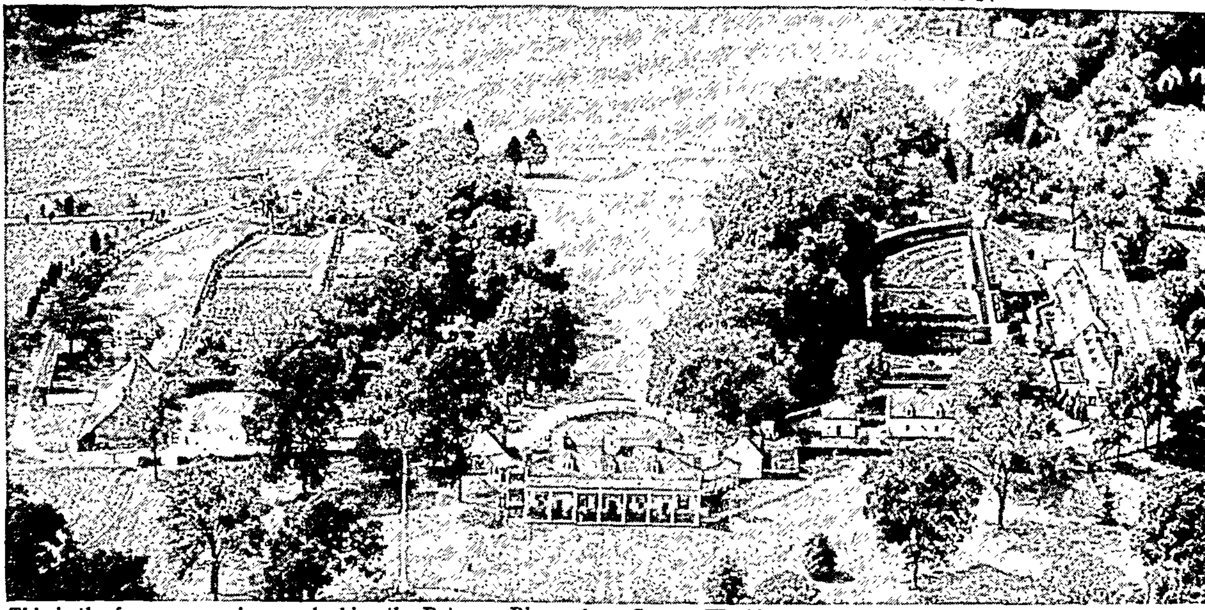
The fact that mountains occur generally near the borders of continents suggests that the settling of ocean basins due to the shrinking of the earth over a cooling interior may have been one cause of their origin. High mountains exist also submerged in the sea. Many chains have been discovered in the Pacific and Indian oceans.

The highest mountains in the world are the Himalayas, the highest peak being Mount Everest (29,028 feet).

Mountain ranges have been formed in several ways: (1) All the great ranges are the result of "folding," a gradual upheaval due usually to some great pressure on the sides, which bends the rock layers upward like an arch. (2) Occasionally the rocks do not bend but break, or "fault," producing mountains which are steep and clifflike on one side, with gentle slopes on the other, like many in western North America. (3) Many mountains (for example, Pikes Peak) owe their existence to the gradual work of rivers in dissecting a plateau, leaving the hard rocks standing in bold relief. (4) Volcanic cones are formed by lava eruptions (*see* Volcanoes).

In the formation of many mountains all four processes have had a part. As soon as mountains begin to rise, erosion commences and continues until they are worn down to a plain, unless they are again uplifted. All lofty mountains, like the Rocky Mountains or American Cordilleras, are comparatively young. The Appalachian Mountains are in a mature stage, and the Laurentian Plateau which has been worn down almost to a plain has reached old age.

WASHINGTON'S HOME AT MOUNT VERNON



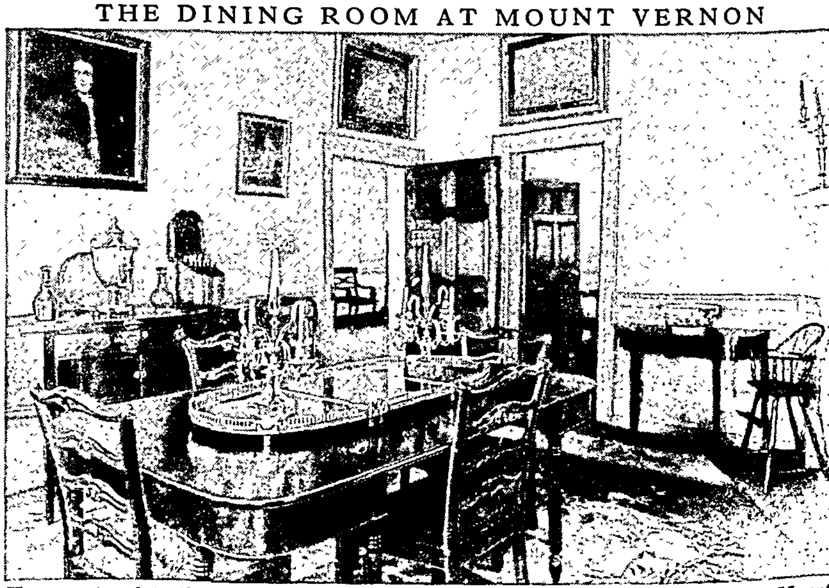
This is the famous mansion overlooking the Potomac River where George Washington lived and where he lies buried. Thousands of visitors each year make the pilgrimage to this most venerated of America's historic relics. The estate was originally called "Little Hunting Creek Plantation," but was named Mount Vernon by Lawrence, Washington's half-brother, in honor of his former commander, Admiral Edward Vernon. George Washington had the original villa enlarged into the present mansion house and planned and superintended the construction of outbuildings and the adornment of the grounds. Many of the trees now growing on the estate were planted by Washington, Franklin, Jefferson, and Lafayette.

Mountains greatly decrease the habitable area of land by their own ruggedness. They also cause aridity on one side or the other by forcing the winds to drop most of their moisture before passing over them. On the other hand, they are the source of the great rivers which develop plains, and they furnish many valuable minerals.

Lofty mountains have been almost as effective as the oceans in serving as barriers to the movement of men and animals and the spread of plants. No railway has yet been laid across the Himalayas, which for many centuries separated India and China from each other, and until 1910 no railway crossed the Andes. The Appalachian barrier was one of the contributing factors that confined the British colonies to the Atlantic seaboard for 150 years. The Pyrenees shut off Spain from Europe almost completely for so many years that it is often said, "Africa begins at the Pyrenees." And for centuries the Alps acted as a barrier between Italy and Germany. Because of this separating tendency, and the protection which they afford from invasion, mountains frequently serve as political boundaries. (*See also* Earth, and separate articles under the names of different mountains.)

MOUNT VERNON, VA. Any American citizen who is asked today what he considers the most interesting historic spot in his country will likely reply, "Mount Vernon," the home and the burial place of George Washington. On a high bluff overlooking the Potomac River, 15 miles below Washington, we may still see this delightful old mansion house, built of wood but painted to resemble stone. Inside you will find the rooms much as they were in Washington's time; for when the Mount Vernon Ladies' Association, in 1859, bought 200 acres of the old estate, including

THE DINING ROOM AT MOUNT VERNON



Here, restored to the way it looked in Washington's time, is the dining room at Mount Vernon. Beautiful crystal glass candelabra stand on the silver tray on the table, and a silver coffee urn graces the sideboard. A child's high chair stands in the corner.

the house, they undertook to restore it to the condition in which it was when "the Father of his Country" was alive. Much of the furniture, especially that in the library and in Washington's bedroom, is the furniture which he used; and in the other rooms, where the Association was unable to buy back the same furniture, they purchased articles of the same kind. The coach in the coach house, for example, is not the one that Washington used in visiting neighboring planters, but it was built by the same man and is exactly like the one Washington owned. The grounds and the gardens surrounding the house are just as they were laid out by Washington, and some of the trees were planted by his own hand.

Although the house and the home grounds are the same as they were at the beginning of the 19th century, the princely estate that was attached is gone. Then Mount Vernon was a plantation of more than 8,000 acres instead of the 200 acres which it now includes. The part we know as Mount Vernon was then included in the Mansion-House Farm, and on this were the house of the owner, quarters for the slaves, the butler's house, and the spinning house. On each of the other farms were "an overlooker's house," quarters for slaves, barns, and stables; and on one of the farms were the old fishery and the ferry to the Maryland side of the Potomac.

At first Washington, like most Virginia planters, was engaged in tobacco raising; but he soon discovered that this crop exhausted the land too much, and so turned to a variety of crops. Each year some of the land was allowed to "lie fallow," or remain idle, to restore its fertility. On the whole, though his estate was large, it did not yield Washington a great return.

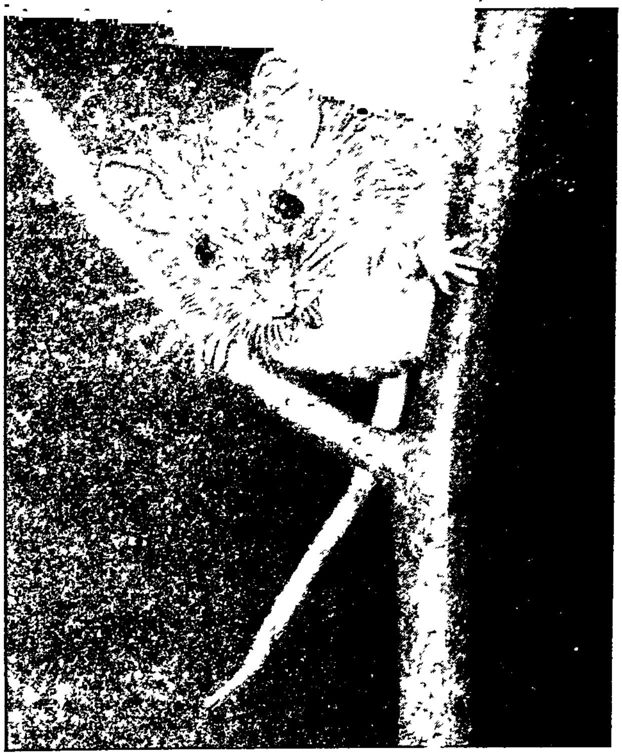
MOUSE. A destructive, unclean little pest is the common house mouse. It not only helps itself to the food in the pantry, but it destroys or damages books, pictures, clothing, and furniture.

It is hunted everywhere, but it thrives nevertheless. It is extremely hardy and prolific. Mice breed about six times a year, and there are six to eleven in a litter. The female carries the young 21 days before they are born. They grow rapidly and are able to care for themselves in three weeks. When they are about two months old they are ready to breed and assume their own family duties.

House mice and their cousins the common rats belong to a family of rodents (gnawing animals) which are native to the Old World. They probably arrived in the Western Hemisphere in the ships of the explorers and early settlers. They live not only in every place inhabited by man, but also in swamps and wastelands, where they may be confused with the native wild mice. The house mouse has a very long, naked, and scaly tail. The fur is brownish, shading to lighter brown on the underparts.

Native wild mice belong to a different family. The tail is shorter than that of the house mouse and somewhat furry; the ears may be furry; and the underparts and feet are often white. There are many kinds.

THE WHITE-FOOTED, OR WOOD, MOUSE



The little white-footed mouse is much more attractive than the house mouse. It has large, appealing eyes, snowy white underparts, and dainty white feet. It is gentle and easily tamed.

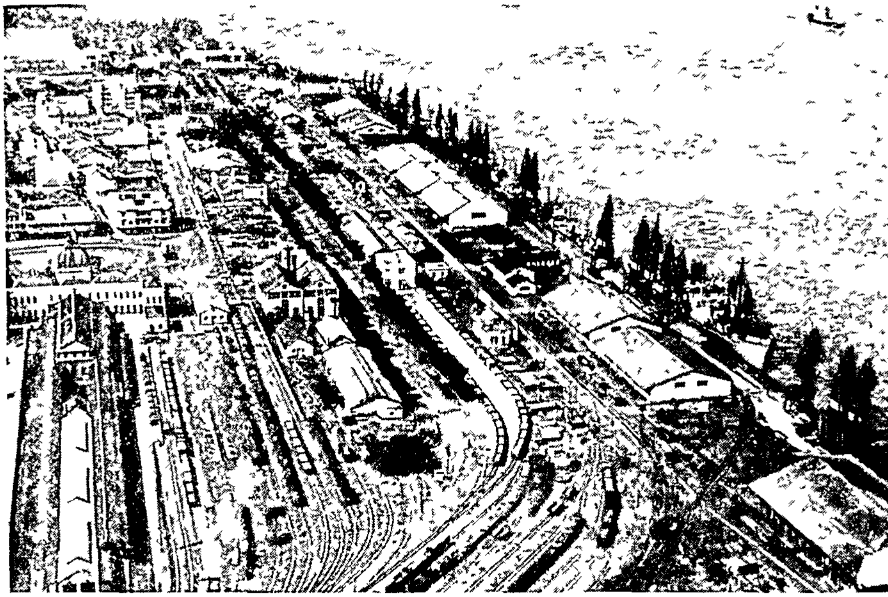
The meadow mouse, also called field mouse and meadow, or field, vole, is the most destructive of the wild mice. It devours crops of all kinds as well as orchard fruits. It has many young, and under favorable conditions these mice increase enormously in numbers and become a serious plague. Fortunately they have countless enemies and are the favorite food of many animals and large birds.

They live wherever they can find low-growing vegetation for food and cover. They build a nest in an underground burrow. Runways leading to the burrow are made by cutting away the grass and keeping the path free of debris. They do not hibernate and are most active at night.

White-footed, deer, or wood mice also live throughout North America, in open country, forests, and brushlands. They feed on wild seeds, fruits, and green plants. They are harmless, attractive little animals. They have a "song" like the trilling of a canary. They are easily tamed and make charming pets.

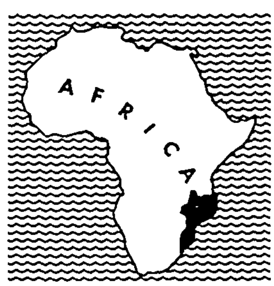
Other interesting and harmless mice are the harvest mice of warm climates and grassy regions; the red-backed mice of cool, damp forests; the tree mice that live in the forests of the northwest Pacific coast; the grasshopper mice of the southwest deserts; and the lemmings (*see* Migration of Animals).

House mice belong to the Old World family *Muridae.* Scientific name, *Mus musculus.* Native wild mice belong to the New World family *Cricetidae.* Meadow mice belong to the genus *Microtus,* of which there are many species; white-footed mice to the genus *Peromyscus,* also divided into many species.



The port of Lourenço Marques, Mozambique's capital, is one of the chief outlets for minerals from the Union of South Africa and the Rhodesias.

MOZAMBIQUE (*mō-zam-bēk'*), or **PORTUGUESE EAST AFRICA.** Portugal's second largest African province is Mozambique, on the Indian Ocean south of the equator. Its area is 297,731 square miles.



Mozambique occupies a large part of the East African coastal plain, with a coast line some 1,500 miles long. Tanganyika borders it on the north; the Federation of Rhodesia and Nyasaland, the Union of South Africa, and Swaziland, on the west and south. (For map, *see* Africa.)

The Land and Climate

Much of the low, swampy coastal region is hot and damp. It is unhealthful because of malaria and the tsetse fly. As the land rises to the great African plateau the climate becomes milder and more suitable for Europeans (whites).

The province is split by the Zambezi River. In the south the Lombobo Mountains divide it from Swaziland and the Transvaal. In the north, close to the coast, the hills are from 5,000 to more than 7,000 feet high. Lake Nyasa forms part of the western boundary. The principal rivers are the Zambezi, Limpopo, Pungwe, and the Ruvuma on the Tanganyika border.

Forests are found mainly in the river bottoms and in the northern hills. Tropical plants flourish in the wet coastal belt. Among the game animals are lions, elephants, hippopotamuses, and crocodiles.

The People and How They Live

In 1950 the province had 5,732,317 people, including more than 5,000,000 Bantu Negroes. The principal tribes in the north are the Makwa and Yaos. South of the Zambezi most of the tribes are related to the Swazi, Basuto, and Zulu of South Africa. Many Bantu from Mozambique go to work in the Transvaal and the Rhodesias. Less than one per cent of the people are Europeans; and many in this group are actually of mixed blood—Portuguese crossed with Negro or Asian Indian.

Climate and soil are generally suited to agriculture. But much of the land has never been cultivated except by primitive methods. The main crops are sugar cane, fruits, corn, sisal, peanuts, tea, cotton, and tobacco. Gold, silver, and tin are mined to some extent.

Mozambique is commercially important as an outlet for the minerals of the Transvaal and the Rhodesias. The principal ports are Beira (42,539) and Lourenço Marques (93,303), the capital.

History

Arabs knew this region in the Middle Ages. Vasco da Gama stopped here in 1498 on his way to India. His reports of Bantu gold mines resulted in Portuguese exploration and colonization. Dreams of wealth failed to come true, and the colony made little progress during the 18th and 19th centuries. Slaves were exported until the trade was abolished in 1878.

After World War I Mozambique acquired part of German East Africa. In 1951 Mozambique and Angola became overseas provinces of Portugal.

A VILLAGE OF THE MAKWA TRIBE

The thatched huts have steeply slanting roofs to shed the heavy rains of the region. The Makwa live north of the Zambezi.

MOZART (*mō'tsärt*), **WOLFGANG AMADEUS** (1756–1791). A winning child genius, petted by sovereigns and princesses, a brilliant youthful composer, acclaimed by his peers as "the musician of musicians" and "the only *musician* in the world"—the artist-drudge of a penurious emperor, harried by debt, privation and overwork to an untimely death, and allowed through cold neglect to go unattended to a pauper's grave—such were the strange contrasts in the life of the "divine" Mozart.

He was born at Salzburg, Austria, where his father was musical director for the archbishop. At the age of three he displayed such interest in the music lessons of his elder sister that the father, a thorough musician, began to give the boy regular daily lessons. When five he not only played the harpsichord well, but also had composed a number of short pieces. When seven years old he went with his family on an extended musical tour. He was a very sweet innocent child. When he slipped on the polished floor of the emperor's castle in Vienna and was picked up by beautiful Marie Antoinette, later queen of France, he said: "You are very kind; when I grow up I will marry you." Everywhere he won great applause by his organ and violin playing. From Paris he was taken to London, where his playing amazed all who heard him. During his stay of over a year in England he composed 10 sonatas for the clavier (an early form of the piano) and violin, six of which were published.

THE BOY MOZART

The young musician is shown here with his violin—the violin with which he played his way into the hearts of all Europe. This statue by the French sculptor Barrias stands in the Luxembourg Museum in Paris.

When 13 years of age Mozart was taken to Italy and for two years traveled from city to city, giving concerts. In Rome he was taken to the Sistine Chapel to hear a famous musical composition of which no copy had ever been published. After hearing it once Mozart was able to write it out entirely from memory.

While in Rome the pope conferred upon him the Order of the Golden Spur, making him, at 13, a "chevalier" or knight. When in Milan he composed an opera which was so popular that it was sung for 20 nights in succession. After his return to Salzburg, Mozart was twice recalled to Italy to direct his compositions for special occasions.

For the next 13 years he gave concerts and composed. The list of his compositions is very long, including operas, symphonies, masses, and other forms of sacred music, besides numerous smaller pieces.

At the age of 26 Mozart married. During the next five years some of his finest compositions were produced, including 'The Marriage of Figaro', and 'Don Giovanni', two of his finest operas. But although these were received with the greatest enthusiasm, the financial recompense to Mozart was comparatively small. The emperor appointed him to a position at the Austrian court, but the salary was low. His wife was extravagant and a poor business manager and Mozart found it demanded all his powers to keep his growing family from want. To help out he took pupils and produced numerous compositions, all the while filling his post at court.

Under the strain his health began to break. During the year 1791 he was engaged on three of his greatest compositions. Besides two operas, he had received a commission to compose a requiem or funeral service, the purpose of which was kept secret. The mystery surrounding the order made a strange impression on Mozart, for in his weakened condition he became convinced that it was his own death dirge that he was composing.

Such it proved to be, for just before it was finished the busy brilliant life of Mozart ended, apparently from typhus fever. There were debts, and there was no money. His wife was ill, and no friends came to aid. So his body was hastily buried in a pauper's grave in one of the cemeteries of Vienna.

Of Mozart's operas the 'Magic Flute' is perhaps his best. Of his many symphonies the one known as the 'Jupiter' symphony is by many considered the finest, and is so masterly it is difficult to believe that it was composed in 15 days. His quartets are equaled only by those of Haydn and Beethoven. His sacred music is churchly and beautiful. The 'Requiem' is the greatest of its kind, and has been used in the funeral services of innumerable musicians.

MUDFISH. "Can a fish live out of water?" "No," says the "man in the street." Then the keeper of the city aquarium opens a package he has just received from far-away Africa, and finds inside a ball of dried mud. It is hard to crack open, so he drops it in one of his big fresh-water tanks. The mud melts away, and suddenly, out of the black mass, a long lively, eel-shaped creature uncurls, stretches, and swims happily away, looking for food.

Scientists call this fish *Protopterus annectans*. The Negro boys in his native land probably have a shorter name for him; but he has not yet been naturalized in America or England, so we give his family title of African "mudfish" or "lungfish." He has a close relative living in the South American river swamps, called by the Indian natives *loalach;* and a more distant cousin in Australia, called *barramunda*.

THIS FISH LIVED IN A MUD CAKE SEVEN MONTHS

Inside the hardened cake of mud (left, above) is an African mudfish (lungfish). It had been out of water seven months when it reached the United States. Next, a scientist has broken away the mud and is removing the cellophanelike covering which the fish secretes before it burrows into the mud. Here (right, above) is the mudfish freed from the casing. Placed in water, the fish soon revives (bottom).

Biologists consider these three fish "living fossils" which have survived from an early geologic age when much of the world's land was almost at sea level. Countless sea-dwelling animals were left on land at low tide. The ancestors of these fish survived by developing tissues in their swim bladders which could get oxygen for the blood from the air. Hence the fish of this group are often called *lungfish.*

Another Common Name Is Mudfish

These lungfish are also called *mudfish,* because they burrow deeply into mud whenever a dry season comes. The glands of the skin secrete a substance which forms a cellophanelike membrane about the fish's body. Where the mouth comes in contact with the membrane, there is a tiny opening. This opening is connected with the top of the mud casing by a narrow passage. Thus the fish breathes just enough air to keep it alive but not enough to dry it out.

Mudfish are medium in size, ranging from 12 to 18 inches in length. They are found in the warmer parts of their respective continents, the African type throughout the equatorial region, and the South American along the Amazon and La Plata river systems.

The third member of this mudfish or lungfish group is the Australian *barramunda,* or Burnett salmon. It is found in northern Queensland and it attains a length of six feet or more. It does not burrow in mud to survive dry seasons; but it can live in muddy water by lying at the surface, gulping air with a grunting noise which can be heard at a great distance.

Many other fish also can be considered mudfish, because of mud-dwelling habits. One of the most unusual is the tiny *goby,* or *mudskipper.* It is found along flat, muddy seacoasts of tropical Africa, Asia, Australia, and the East Indies.

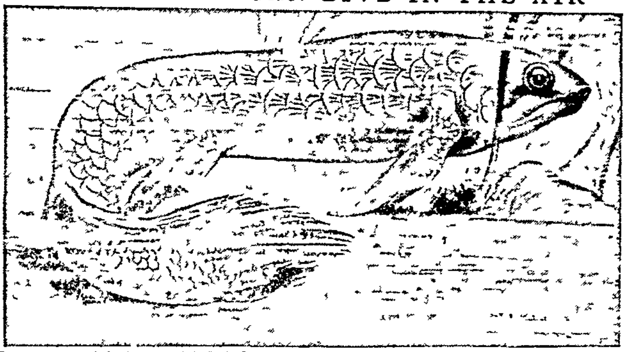
The goby can use its strong side fins to crawl or hop on land, somewhat like a seal. It lives on mud flats or climbs up on roots and rocks to capture insects. Its gills are so well suited for absorbing oxygen from air that it cannot remain under water very long. Another adaptation to land life is the location of its eyes on short stalks above the head. With these it can see in every direction.

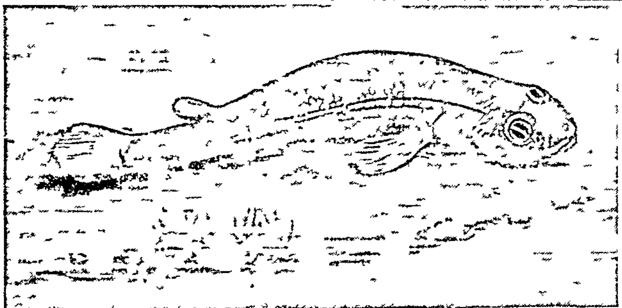
Another odd fish is the *foureye,* or *four-eyed fish,* found in tropical rivers of Central and South America. It is so named because each eye is divided by a dark horizontal band. The portions above the bands are adapted for seeing in air, and those below for seeing under water. Thus the fish, by moving along at the surface, can see both above and below. It moves by skips or jumps over the surface of the water or on mud flats, in search of insect food.

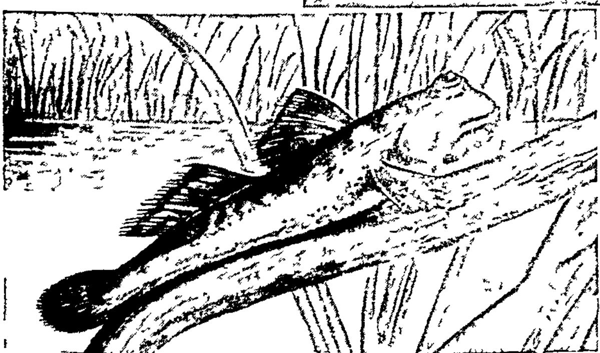
Many North American fish burrow in mud, either to escape cold or to find food. The little *mud minnows* of the central United States penetrate mud for both purposes. The same region also has the North American mudfish, or *bowfin,* which hunts crawfish and other food in muddy shallows. It can survive the winter in mud and live a long time out of water. The small killifish, called a *mummichog,* scarcely three inches long, lives in muddy shallows from Maine to Mexico. Alaska contributes the *blackfish,* about eight inches long. It survives the severe Arctic winters buried in mud.

Scientific names African mudfish, *Protopterus annectans;* loalach, or South American mudfish, *Lepidosiren paradoxa;* barramunda, *Neoceratodus forsteri;* mudskipper, *Periophthalmus koelreuteri;* four-eyed fish, *Anableps anableps;* mud minnow, *Umbra limi;* bowfin, *Amia calva;* mummichog, *Fundulus heteroclitus;* Alaska blackfish, *Dallia pectoralis.* The first three constitute the lungfish order, *Sirenoidei*

THESE FISH CAN LIVE IN THE AIR







The queer lungfish can't make up their minds whether to be fish or not. The Australian barramunda (top) lives in muddy water and gulps air at the surface. The foureyes (center) swims with its head half out of water and sees both above and below. It can skip rapidly over mud flats. The East Indian goby (bottom) often goes ashore in search of insects.

MUIR, JOHN (1838–1914). Yosemite and Sequoia national parks, the national forests of the United States, and several national monuments owe their existence to John Muir, naturalist, explorer, and writer. His love of the forests and mountains of the West, his enthusiasm and ability to fire others with his ideals saved these areas for the nation.

John Muir was born at Dunbar, Scotland. In 1849 the Muir family emigrated to America and settled on a farm near Portage, Wis. Early each morning, before John began his heavy farm tasks, he studied grammar and mathematics and read every book he could buy or borrow for miles around. When he was 21 he entered the University of Wisconsin. He left without a degree, for he studied only the subjects which interested him—chemistry, geology, and botany. In later years he received honorary degrees from Wisconsin, and from Harvard, Yale, and the University of California.

In 1867, after an injury to his eye threatened him with blindness, John Muir turned to travel and nature study. He started out on foot from Indianapolis, where he had been employed in a wagon factory, and traveled to Panama and northward into California. For six years he lived alone in the Yosemite Valley, exploring the glaciers and forests of the Sierra Nevada. Next he traveled to Alaska. There he discovered Glacier Bay, now a national monument, and the great glacier named for him.

After his marriage in 1880 he devoted ten years to his California fruit ranch. His gift for horticulture brought him financial success and freedom for travel and writing. He studied in particular the forests of Russia, Manchuria, India, Australia, New Zealand, Africa, and South America.

Through his writings Muir stimulated a public demand for conservation of the forests, leading in time to the establishment of national forests. In 1903, on a camping trip in Yosemite with Theodore Roosevelt, who was then president, he imparted to him much of his own enthusiasm. During the remainder of Roosevelt's presidency 148 million acres of forest reserve were set aside as national forests, 16 national monuments were established, and the number of national parks was doubled.

Among Muir's chief works are: 'The Mountains of California (1894); 'Our National Parks' (1901); 'Stickeen' (1909); 'My First Summer in the Sierra' (1911); 'The Yosemite' (1912); 'Story of My Boyhood and Youth' (1913); 'Travels in Alaska' (1915); 'A Thousand Mile Walk to the Gulf' (1916).

MULBERRY. Without the mulberry tree we would not have the exquisite silks of commerce, for the silkworm does not thrive or produce the fine silk filaments for its cocoon unless it has as its food the tender leaves of the white mulberry tree. Mulberries are found in the temperate regions of the world and are cultivated for silk growing, for the fruit, and as ornamental trees. There are three well-known species—red, black, and white—named from the color of the fruit.

The white mulberry, the silkworm mulberry, is a native of China. It was brought to America when the early colonists attempted to raise silkworms. Though they failed to establish the silkworm culture as an industry, the trees they imported have developed into some of the leading fruit varieties of North America. The chief centers of cultivation and of silk growing are China, Japan, India, France, Iran (Persia), and Turkey (*see* Silk).

The black mulberry, the fruit-bearing mulberry of Europe, is not grown to any extent in the United States, though it has been known since earliest times. It was probably introduced to Europe from Persia. Its large, dark purple, almost black fruit, juicy and delicious, looks like a long, slender blackberry.

The red mulberry, a native of North America, has fruit of a pleasing tartness, which relieves the sweet-

ness characteristic of the fruits of all mulberry trees. In some parts of Europe this tree is cultivated in preference to other kinds because of its hardiness. None of the mulberries are planted extensively in North America, however, because the fruit is too soft to market. In some of the western United States the Russian mulberry, a variety of the white, is planted as a windbreak. Some varieties are cultivated for their ornamental forms, the most popular in America is the weeping mulberry.

A member of a closely allied genus is the paper mulberry, the bark of which is used for making paper in Japan. The islanders of the Pacific also make a fabric called "tapa cloth" from it by soaking the bark, removing the outer layer, and then laying the remainder on a smooth table and beating it until it has the required thinness.

The scientific name of the white mulberry is *Morus alba;* black mulberry, *M. nigra;* red mulberry, *M. rubra.* The trees are small, the red mulberry, the largest species, occasionally reaches a height of 60 feet. The leaves are variable. The same tree may bear leaves of several forms, while different trees of the same species show strong individual shapes.

MULTIPLICATION—*A Basic* ARITHMETIC SKILL

MULTIPLICATION. Two ways of finding the cost of three loaves of bread at 25 cents a loaf are shown in the picture at the right. In example A, the cost is found by adding three 25's. In B, the cost is found by multiplying 25 by 3. In both examples the answer is 75. In the same two ways we could also find the cost of 9 loaves of bread. Obviously, multiplying 25 cents by 9 is a much shorter process than writing a column of nine 25's and then adding the numbers to find their sum. Multiplication is a quick way of finding the sum of two or more numbers of equal size.

A.

$$\begin{array}{r} 25¢ \\ 25¢ \\ +\underline{25¢} \\ 75¢ \end{array}$$

B.

$$\begin{array}{r} 25¢ \\ \underline{\times 3} \\ 75¢ \end{array}$$

Each loaf costs 25 cents. The numbers to be added are equal. Multiplication is a quick way of adding equal numbers.

If we work the example in B, we can determine the facts and skills that are required to find the answer. They are the following:

1. Two multiplication facts are used: $3\times5=15$ and $3\times2=6$.
2. After we multiply 3×5 in ones' place, we must change (regroup) the 15 as 1 ten and 5 ones, write the 5 in ones' place in the answer, and remember the 1, which is to be carried to tens' place.
3. Then, after multiplying 3×2 in tens' place to get 6, we must add the 1 to the 6, and write the sum 7 in the answer.

In both examples A and B, there is carrying from ones' place to tens' place. Notice, however, that in the addition example, we start with the carried number in adding the tens, while in the multiplication example, we add the carried number *after* we have multiplied the 2×3.

In order to be able to multiply quickly and correctly, the 90 basic multiplication facts must be learned. These facts should be used and practiced until the products (answers) can be given quickly and correctly. In the chart on a later page, the 90 multiplication facts are given. They are grouped for study and practice. Notice that in each row, the multiplicand is always the same. Since zero (0) is not used as a multiplier in arithmetic, there are no facts in which zero is the multiplier.

TERMS USED IN MULTIPLICATION

7	*Multiplicand*	The sign (×) says times, or multiply.
×4	*Multiplier*	
28	*Product*	

How to Give Meaning to Multiplication

In former years, the multiplication facts were often taught as tables to be memorized. Children sometimes repeated a whole table to get the answer to one number fact. Often the meaning of the facts was not explained, and the children had no meaningful way of working out the answer to a fact that they could not recall. Children who did not learn the facts made many errors in working the longer multiplication examples. It is now known that inaccurate work in multiplication is more often due to faulty knowledge of number facts than to any other cause.

In teaching the multiplication facts, teachers today begin by teaching their meaning in relation to addition. Children should learn to use addition and also any known multiplication facts to find the products of new facts or products that they cannot recall. For example, to find the answers for the groupings in which 2 is the multiplier, they can use the addition doubles. Thus, the double $6+6=12$ can also be written as the multiplication fact $2\times6=12$. In this way, all of the other facts for twos, including their products, can be found. *After* this has been done, these facts can be listed as a table to organize them in a systematic way. A discussion of the list of facts will bring out ideas that will help children to remember the products. For example, the products are the same as the numbers we name when counting by twos: the product of 2×6 is 2 more than the product of 2×5, and so on. It is not expected that the table itself will be memorized.

The reverse facts in which 2 is multiplied by each of the other numbers from 1 to 9 should next be taught. Thus, 6×2 is the reverse of 2×6. To find the product of 6×2, or 6 twos, the child can count six groups of two objects each or he can add a column of

six twos. In the same way, the meaning of the other reverse facts for twos can be developed. The children will quickly learn that the product of any fact and its reverse, such as 2×6 and 6×2, are the same. This idea will greatly assist them in learning all the other multiplication facts. Learning one fact assures the learning of the reverse fact.

Steps in Teaching the Multiplication Facts

1. Show the need of learning the multiplication facts.
2. Teach the multiplication facts as groups of related facts, beginning with the twos, which are the easiest facts.
3. Every multiplication fact should be the written record of some experience. Thus $2\times3=6$ might be the record of an activity in which the children found the cost of two 3-cent stamps.
4. Develop the meaning of each fact by means of counting objects, or pictures of groups of objects, and also by using addition to find the product. Make every fact meaningful.
5. Teach a group of related facts, such as the 2's or the 3's, and also their reverses at the same time.
6. Help the children to discover general ideas about the multiplication facts that will organize what they are learning and will help them to remember facts that are related to each other. A list of such ideas is given in the table on this page.
7. Give the children the opportunity to use these facts frequently in social situations, such as finding the cost of a number of stamps, the cost of a few half-pints of milk, and the like. Have them give original problems in which the facts are used.
8. Provide systematic practice in the facts through the use of games, practice cards, and written exercises when it is certain that the children understand the facts.

The process of multiplication itself is easy to learn. The important thing to remember is that the multiplication facts must be known so well that their products can be given quickly and correctly. The rate at which the products are given will, of course, be rather slow when they are first being learned in the lower grades, but systematic practice through the following years will greatly increase the speed. In general, the larger the product, the more difficult it is to learn the fact.

Steps in Teaching Multiplication Examples

The examples below show the order in which the steps in multiplication should be taught. The first step involves no difficulty other than learning where to begin, what to think, and what to write. Each succeeding example involves a new difficulty, which is indicated in the notes beside the example.

Step I. No difficulty other than procedure:

$$\begin{array}{r} 43 \\ \times2 \\ \hline 86 \end{array}$$

Begin at the right in ones' place.
Think: $2\times3=6$. Write 6 in ones' place in the answer.
Next, multiply the 4 tens. Think: $2\times4=8$. Write the 8 in tens' place in the answer.

Step II. Carrying to tens' place:

$$\begin{array}{r} {\scriptstyle 1} \\ 26 \\ \times3 \\ \hline 78 \end{array}$$

Begin at the right in ones' place.
Think: $3\times6=18$. Because 18 is 1 ten and 8 ones, write 8 in the answer in ones' place. Remember (carry) the 1.
Next, multiply the 2 tens. Think: $3\times2=6$. Add the 1 (carried) to 6. Write 7 in tens' place in the answer.

The new difficulty in Step II is carrying to tens' place. This step is similar to the carrying done in working addition examples. (*See* Addition; Number System.) Adding three 26's shows that the product 78 is correct.

After the child has learned the method of carrying to tens' place when multiplying a two-place number, he very easily learns the method of carrying to the hundreds' and the thousands' places when multiplying larger numbers. These steps are shown in the following examples:

Step III. Carrying to hundreds' place only:

$$\begin{array}{r} {\scriptstyle 1} \\ 251 \\ \times3 \\ \hline 753 \end{array}$$

Here the 15 tens (3×5 tens) must be changed to 1 hundred (10 tens) and 5 tens.

Step IV. Carrying to both tens' and hundreds' places:

$$\begin{array}{r} {\scriptstyle 4\,3} \\ 286 \\ \times5 \\ \hline 1430 \end{array}$$

Here the 30 ones (5×6) must be changed to 3 tens and no ones, and 0 written in the product. The 3 is carried to tens' place and added to 40 (5×8), making in all 43 tens. The 3 is written in tens' place in the product and the 4 carried to hundreds' place.

SPECIAL HELPS IN LEARNING THE MULTIPLICATION FACTS

These general ideas will help children to organize what they are learning and to remember facts that are related.

$$\begin{array}{r} 1 \\ \times7 \\ \hline 7 \end{array}\quad \begin{array}{r} 6 \\ \times1 \\ \hline 6 \end{array}\quad \begin{array}{r} 0 \\ \times4 \\ \hline 0 \end{array}\quad \begin{array}{r} 4 \\ \times0 \\ \hline 0 \end{array}\quad \begin{array}{r} 9 \\ \times3 \\ \hline 27 \end{array}\quad \begin{array}{r} 4 \\ \times5 \\ \hline 20 \end{array}\quad \begin{array}{r} 7 \\ \times5 \\ \hline 35 \end{array}$$

When a figure is multiplied by 1, or when 1 is multiplied by a figure, the product is the same as the figure. $7\times1=7$ and $1\times6=6$ show this.

When 0 is multiplied by a figure, or a figure is multiplied by 0, the product is 0. 4×0 and 0×4 show this.

Any multiplication fact and its reverse—for example, 3×9 and 9×3—have the same product.

The products of the fives end in 0 or 5. The facts $5\times4=20$ and $5\times7=35$ show this.

When an even number is multiplied by 5, the product ends in 0. When an odd number is multiplied by 5, the product ends in 5.

The sum of the figures in any product of the nines is 9. For example, $9\times3=27$, and $2+7=9$.

Multiplying a figure by 9 is the same as multiplying the figure by 10 and then subtracting the figure from the product.

HOW TO PRACTICE THE 90 MULTIPLICATION FACTS

0	0	0	0	0	0	0	0	0
9	2	1	7	5	8	4	6	3
0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1
3	7	8	4	6	9	2	1	5
3	7	8	4	6	9	2	1	5
2	2	2	2	2	2	2	2	2
1	9	6	3	4	8	2	5	7
2	18	12	6	8	16	4	10	14
3	3	3	3	3	3	3	3	3
3	1	9	5	8	2	6	4	7
9	3	27	15	24	6	18	12	21
4	4	4	4	4	4	4	4	4
2	8	5	9	6	3	1	7	4
8	32	20	36	24	12	4	28	16
5	5	5	5	5	5	5	5	5
1	9	5	8	2	6	4	7	3
5	45	25	40	10	30	20	35	15
6	6	6	6	6	6	6	6	6
5	9	1	4	8	2	7	3	6
30	54	6	24	48	12	42	18	36
7	7	7	7	7	7	7	7	7
4	1	9	5	2	8	3	6	7
28	7	63	35	14	56	21	42	49
8	8	8	8	8	8	8	8	8
5	1	9	6	2	3	7	8	4
40	8	72	48	16	24	56	64	32
9	9	9	9	9	9	9	9	9
7	1	5	8	9	3	2	6	4
63	9	45	72	81	27	18	54	36

Special work with this chart will increase both speed and accuracy in working longer multiplication examples. Parents can supervise this practice if they wish to do so.

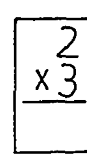
1. Begin with the first row. Read the first fact. Then close your eyes and say it to yourself several times. For more practice write the fact several times on a sheet of paper. Do the same for the rest of the facts.

2. Cover the products of a row of facts with a strip of paper. Then write the products of the examples on the paper. Next, slide down the paper to see if your answers are correct.

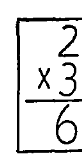
3. Have someone read the facts to you one at a time. You give the product and have the other person check it.

4. Make lists of all facts whose products are 24. Then do the same for the following numbers: 25, 27, 28, 30, 32, 35, 36, 40, 42, 45, 48, 49, 54, 56, 63, 64, 72, and 81.

Make a test-study card for each fact you find difficult. Stack the cards with the test sides face up. Give the answer to the top card, then turn it over to see whether your answer is correct. Put aside those you answer quickly and correctly. Put in another pile those that need further study.



TEST SIDE



STUDY SIDE

Steps I to IV include the main skills that must be learned and understood in order to multiply by any one-place whole number.

In multiplying by two-place numbers, the only new steps to learn are how to place the partial products and then to add them to find the final product, as shown in Step V below:

Step V. Multiplying by an easy two-place number:

The multiplier 12 is the same as 1 ten and 2 ones, or 10+2.

First multiply 14 by 2. This is 28.

Next multiply 14 by 10. This is 140.

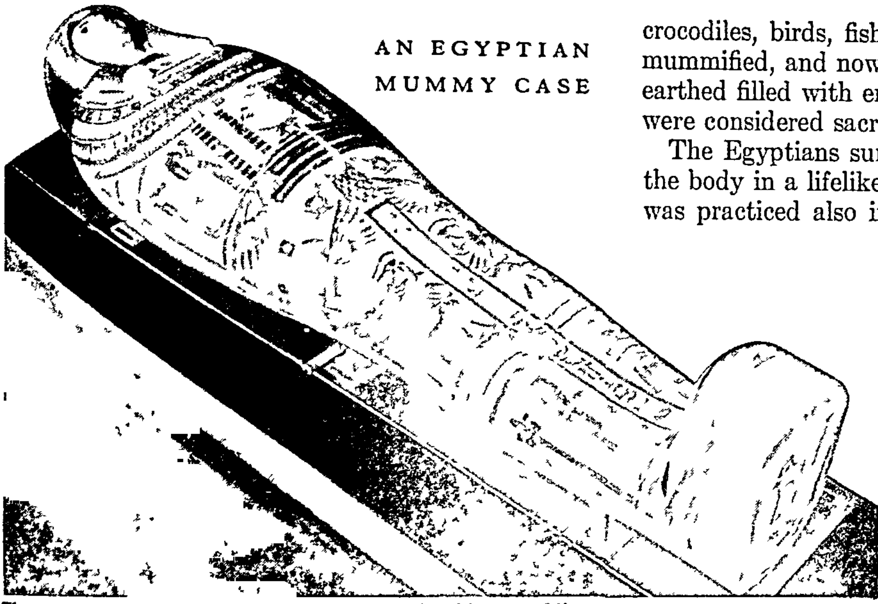
Now add the 28 and the 140, the two partial products. The sum is 168, which is the final product in the example.

$$\begin{array}{r} 14 \\ \times 12 \\ \hline 28 \\ 140 \\ \hline 168 \end{array}$$

The general method used in multiplying by any two—or more—place numbers is the same as the work shown in Step V. The work becomes more difficult when there is carrying and when the addition of the partial products becomes more complicated.

Computing machines use the method of addition to find the product of two numbers. To find the product of 7×36, all that is necessary is to press down two keys to show 36, fix the "repeat" button, and then repeat the number 36 seven times. The machine prints the answer on a strip of paper. (*See* Calculating Machine.)

The processes used in multiplying *fractions*, decimals, and measurements are explained in the articles on those processes. (*See also* Number System; Arithmetic; Addition; Subtraction; Division.)


AN EGYPTIAN MUMMY CASE

The mummy case, in human shape, was made of layers of linen cloth glued together. A face was painted on it and it was decorated with religious symbols.

MUMMY. In the great museum of Egyptian antiquities at Cairo, throngs of curious sight-seers daily look into the very faces of the pharaohs and nobles of Egypt who ruled thousands of years ago. Thousands of such mummies, or embalmed bodies, have been taken from the sands and tombs of Egypt, and perhaps millions more yet lie hidden; for the Egyptians practiced the art of mummifying their dead for 3,000 years or more, believing that the soul would some day return to the body and occupy it again.

The bodies were preserved by the use of bitumen, spices, gums, and so forth, or sometimes by immersion in saltpeter. After soaking for 70 days they were wrapped carefully in linen. Then the shrouded mummy was usually placed in two cases of cedar, or of cloth stiffened with glue, made to fit the corpse. The inner case was plain, but the outer one was often covered with paintings and hieroglyphics telling of the life and various deeds of the deceased. A molded mask of the dead or his portrait on linen or wood sometimes decorated the head end of the case. This double case was placed in an oblong coffin and deposited in a sarcophagus.

The bodies of the poor were merely dried with salt and wrapped with coarse cloths. Sacred animals—lions, dogs, crocodiles, birds, fishes, and even insects—were also mummified, and now and then whole shelves are unearthed filled with embalmed cats who centuries ago were considered sacred in Egypt.

The Egyptians surpassed in this art of preserving the body in a lifelike condition, but mummy making was practiced also in Peru and Mexico. The oldest mummy known to exist is supposed to date from about 3000 B.C. (*See* Egypt, Ancient.)

MUNICH (*mu'nĭk*), **GERMANY.** The people of Munich (German, *Munchen*), capital of Bavaria, have both a rich heritage and a tragic heritage. In the 19th century, cultured, liberal Ludwig I, king of Bavaria, made Munich a great world center of learning, art, music, and drama. In the 20th century a power-mad dictator, Adolf Hitler, defaced Munich by establishing it as the "shrine city" of the infamous Nazi party. Hitler not only made it the seat of the "party management," but also ringed the beautiful city with huge armament industries.

This production of war weapons made Munich a target for Allied air raids during the second World War.

UNWRAPPING A MUMMY

Inside the case lies the mummy. Endless strips of linen cloth, daubed with gum, were wrapped around the body. The body itself was first treated so that it would not decay. Embalmers emptied and washed out the body cavities and then put the corpse into a bath of saltpeter for 70 days. The pictures are from the Oriental Institute, University of Chicago.

Because of its protected location, deep in southern Germany only 25 miles from the Bavarian Alps, it was not raided until late in the war. Though it suffered less damage than some other great German cities, many of its handsome old buildings were destroyed; and its industrial areas were bombed into ruins.

The People Rebuild Their City

Like most Bavarians, the people of Munich have a spirit that is warm, sunny, and sturdy. They quickly turned to restoring Munich as the chief city of southern Germany. They rebuilt industries, such as the electrical, mechanical, and textile. Brewers made special effort to restore Munich beer to the fame earned by the city's brew masters.

Munich's principal effort, however, was to regain prominence as a commercial and cultural center. It has long had a commercial advantage. The city stands at 1,075 feet on one of the few large farming plains that slope down from the Bavarian Alps. Farms surround the city, which rises on both banks of the Alpine-born Isar River.

Originally this site was only a crossing on the salt trail from Salzburg ("salt city"). In 1158 a Bavarian duke, Henry the Lion, built a mint and toll bridge on the site of Munich. In 1504 it became the capital of the kingdom of Bavaria, but the ancient Roman city of Augsburg dominated the region until Ludwig I ascended the Bavarian throne in 1825. He spent his reign of 23 years building splendid art galleries, a museum, theaters, churches, and Munich University. He made the finest music available to the people and encouraged all the arts. He and his successors brought the works of the world's finest painters and sculptors to their many museums.

Magnificent boulevards replaced narrow, twisting streets, and beautiful parks and commons on both sides of the river provided playgrounds for the whole city. Visitors came from all over the world to enjoy Munich's educational advantages, its carnivals, and its festivals. The people of Munich became widely known for friendliness and hospitality.

In this pleasant atmosphere had grown up generations of skilled craftsmen—stained-glass makers, silversmiths, wood carvers, and bronze founders. Lithography was invented in Munich by Alois Senefelder at the end of the 18th century and was extensively used there. In Munich too beer making had been developed with great skill. The secrets were carefully guarded by the brew masters who handed them down from one generation to the next.

Munich under Adolf Hitler

This was Munich until Adolf Hitler and his National Socialist party started their ruthless march toward world domination. The Nazis built a huge, austere Führer's ("leader's") Building and an Administrative Building on the charming old square. There too they built the pillared "temple of honor," to commemorate the 16 Nazi "martyrs," who were killed in the first and unsuccessful "beer hall putsch" of the party in 1923 (*see* Hitler). In that same beer cellar Hitler narrowly escaped death when a bomb exploded there in 1939. The Führer's luxurious home, with its elaborate bomb shelter, faced the main square. After the American 7th Army took Munich, April 29, 1945, they destroyed all Nazi memorials. Population (1950 census), 831,937.

MUNICIPAL GOVERNMENT. Community living creates a need for special public services such as fire and police protection, sidewalks and streets, water supply, and sanitation. To provide these services the community usually organizes (incorporates) into a village or city with its own *municipal government*. It then has the power to levy taxes and appropriate public funds to carry out the necessary public services.

Three out of every four people in the United States live within the jurisdiction of some form of municipal government. In all, there are more than 16,000 such government units in the nation. People living in unorganized, or unincorporated, areas are governed locally by the township ("town" in New England; and to a lesser extent, New York and Wisconsin) or county or a combination of the two (*see* County; Township).

How a Community Becomes Incorporated

The question of incorporation is usually voted on by the people in a community. If the measure is approved, the right to incorporate may be granted by the state legislature. The community then receives a *charter* to establish a government. Most states require a minimum number of inhabitants for each type of

MUNICH REBUILDS FROM WAR RUINS

The slender spires of the Gothic-style city hall rise above temporary shacks built on the Marienplatz in Munich. Air raids in World War II scarred much of the city.

incorporation—several hundred for a village and from one thousand to ten thousand for a city (*see* City).

The kind of city charter granted varies from state to state. In general, however, there are four classifications of charters: (1) the legislature grants a special charter to each city; (2) the state provides several types of charters and the city receives the one applicable to its population; (3) the city may choose a charter from among several alternatives; and (4) the state has a home-rule charter system which allows each city to frame its own charter subject to stated limitations.

A village government usually consists of a board of trustees or a council composed of three to nine elected members. The chief executive officer, called a mayor or village president, may be popularly elected or chosen by the village board from its own membership. Throughout the United States, villages differ widely in size, exact form of government, and functions. Most small municipalities, however, are concerned chiefly with managing the various public services of the community.

Larger boroughs and incorporated towns follow a similar plan of government but their machinery is more elaborate. The government of a city is more complicated because it has more problems to meet.

Three Types of City Government

The oldest and most common form of municipal rule is the mayor-council government. The mayor, usually elected for two or four years, is the executive head. Responsible to him are the heads of the different municipal departments such as police, water, and health. The council, which is responsible for municipal laws (ordinances), consists of a single chamber. Its members, called aldermen or councilmen, are elected from the different wards of the city, or by the voters at large, or by a combination of methods. They usually serve from one to four years. The powers of the council vary in different cities. In general, however, it enacts local ordinances and confirms or rejects the mayor's appointments to office. It can override a veto of the mayor by a two-thirds, or a three-fourths, vote. The judicial branch of a city consists of the municipal courts (*see* Courts of Justice).

As a city grows, the departments tend to increase in number, and government becomes more and more cumbersome. A number of cities, such as Boston and New York, have simplified administration by centering all executive powers in the mayor. This plan has become increasingly popular because municipal government is chiefly administrative in character. There is little need for the democratic safeguards provided by dividing authority equally between the mayor and council.

A simpler and more direct form of government, called the commission plan, was instituted by Galveston, Tex., in 1900 and Des Moines, Iowa, in 1907. A group of commissioners, usually five, is elected at large. Each commissioner becomes head of one of the departments of government, and the commissioners meet together to enact legislation.

The chief defects of commission government are: (1) it fails to provide a central control over the entire administrative work of a city; and (2) it may result in the election of commissioners who do not have the necessary technical qualifications to administer a municipal department.

Out of the commission plan has grown the city-manager, or council-manager, plan. Under this form of government a commission or council, elected by plurality voting or by proportional representation, determines city policy. Administration is in the hands of a manager who is employed by the policy-making body and may be dismissed by it. The manager appoints all subordinates. The chief advantage of this system is that policy is determined exclusively by an elected body. The execution of the policy is in the hands of a trained administrator.

In 1913 Dayton, Ohio, became the first large city to adopt this form of government. By 1950 about 1,000 cities were operating under the manager plan, one third of them adopting it since the second World War. Another postwar development was the practice in many cities of employing administrative assistants to the city manager (or as deputies to the mayor). This device was another step toward centralization of duties to provide more efficient administration.

Relationships with Other Governments

Once a city receives its charter it is able to exercise considerable self-direction in managing its own affairs. Most states, however, retain the power to create and combine local governments, regulate almost all local finance, and administer grants-in-aid for education and housing. In other fields, problems often arise that seem to concern the municipality and the state equally. In many cases the courts must settle the disagreement; and when doubt exists as to the jurisdiction involved, the courts usually favor the local government.

A strict interpretation of the Federal Constitution places the administration of cities exclusively within the jurisdiction of the state governments. Since the 1930's, however, the national government has tended to deal more and more directly with municipal governments. Such matters include slum clearance, low-cost housing projects, public works, bankruptcy legislation, relief, and rent controls.

MURILLO (*mū-rĭl'ō*, Spanish *mụ-rēl'yō*), BARTOLOMÉ ESTEBAN (1617–1682). The young man of 25 was footsore and exhausted. He had walked 250 miles across the Sierra Moreno, from Seville to Madrid, in Spain. Young Bartolomé Murillo was penniless and without friends, but he carried with him a precious possession—the talent that was to make him one of Spain's greatest painters. He knew no one in Madrid, not even the man he had come to see. This man was Diego Velasquez, court painter to the king. Velasquez himself had come from Seville many years before, and now Murillo had followed him to the Spanish capital.

Murillo was born in 1617 in Seville and was baptized Jan. 1, 1618. His parents died when he was a child and he was placed with a local artist, Juan

MURILLO'S 'IMMACULATE CONCEPTION'

In this painting, one of three versions by Murillo on the same subject, the Virgin hovers in the clouds, supported by cherubs.

del Castillo. Under him Murillo learned to turn out religious pictures that were sold to small churches in Spain and in the Spanish colonies in America. Even at this simple work, Murillo showed talent and was encouraged to go on. Some of these early paintings are prized in museums today.

In Madrid Velasquez welcomed his young fellow-townsman and gave him a room in his own house. The famous painter obtained permission for Murillo to study by copying Italian and Flemish masterpieces in the royal galleries and helped him in many other ways. (*See also* Velasquez.)

Murillo progressed rapidly. In two years Velasquez exhibited some of his work to the king and the court Murillo was on the way to fame and wealth in Madrid, when he decided to return to Seville. There he soon found his old friends and new admirers of his work. His first important project was to paint 11 large pictures for the walls of the cloister in the convent of San Francisco. He married a wealthy woman of society and settled down to become a well-loved painter and sponsor of other artists. In 1660 he helped found a public academy of art in Seville and served as its first president.

In 1681 he was in Cadiz, painting the 'Espousal of St. Catherine' on the walls of the Capuchin monastery. He fell from the scaffold, and his injuries resulted in his death on April 3, 1682. He was buried in the church of Santa Cruz in Seville.

Among the pictures painted when Murillo was a youth are many sympathetic studies of the ragged boys and the flower girls of Seville. His later works are nearly all serene religious compositions, marked by splendid coloring, great technical skill, and pious intensity. His few portraits are lifelike and beautiful, and the birds and animals shown in his pictures are extremely realistic.

The 'Immaculate Conception' shown on this page is one of three famous versions painted by Murillo. This and a second version hang in the Museum of the Prado in Madrid. A third hangs in the Seville Museum. St. Anthony of Padua was another of the subjects that he painted several times. Many people like best the series he painted for the Charity Hospital in Seville. Among these are 'Moses Striking the Rock', 'St. Elizabeth of Hungary Tending the Sick', and 'St. Peter Released from Prison'.

How MUSCLES MAKE *Our* BODIES WORK

MUSCLES. All movement of the body depends on muscles. By contracting and relaxing, muscles move our legs and arms, turn our eyes, and make our faces smile or frown. Muscles of the heart pump the blood through the circulatory system. Muscles in our tongue and jaws help chew the food we eat. The walls of the digestive system contain strong muscles that churn the food and keep it moving. Muscles in our skin produce "gooseflesh" when we are chilled. Similar muscles in a cat's skin raise its hair when it becomes frightened or angry.

Another important job of the muscles is to release heat. This heat helps keep our bodies at normal temperatures. When we are cold, a shiver is the body's way of producing a muscular action that generates quick heat.

Muscles are made up of thousands of threadlike cells, or fibers. These are grouped in bundles wrapped in thin fibrous tissue. The fibers are linked to the nervous system by motor nerves (*see* Nerves). When nerve impulses reach the fibers, they respond by contracting, becoming shorter and thicker. When the nerve impulses stop, the fibers relax, returning to their longer, thinner shape.

Not all muscle fibers work at the same time when a muscle is contracting. The force exerted by the muscle depends on the number at work. Fibers at work, however, contract fully. The others are fully relaxed.

Thus "all or nothing" is the rule for the contraction or relaxation of fibers. Scientists believe that when the muscle develops, as through exercise, the number of fibers remains the same but each fiber grows thicker and stronger.

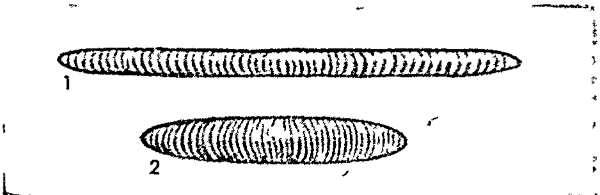
A good muscle to watch in action is the biceps muscle of your upper arm. At the top this muscle is attached by tendons to the tip of the shoulder bone and at the bottom to one of the bones of the forearm, the radius. The shoulder connection is called the *origin,* and the other attachment is the *insertion.* As you bend your arm the biceps contracts and pulls the forearm towards the shoulder. You can feel the fibers in the biceps bulge as they contract and lengthen out as the muscle relaxes.

Three Kinds of Muscles

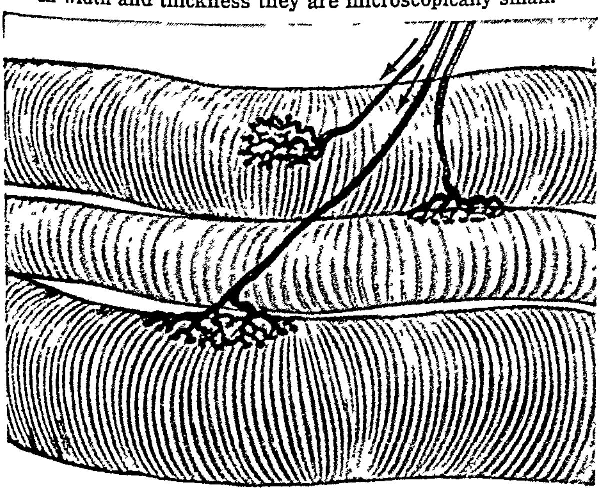
The body has three kinds of muscles. Each has a different kind of fiber and each does a different kind of work. One kind, the *voluntary* muscles, carry out the movements that we more or less want to make. The muscles that control breathing are voluntary, even though they continue while we sleep. Walking uses voluntary muscles, but the action is so much a habit that we do not have to "think" as we walk.

The voluntary muscles that are linked with the bones—for example, muscles that move the limbs—are also called *skeletal* muscles. Skeletal muscles make up about 40 per cent of the weight of the human

HOW VOLUNTARY MUSCLE FIBERS ACT



This striped fiber is shown relaxed (1) and contracted (2). Such fibers vary in length from less than one inch to several inches. In width and thickness they are microscopically small.



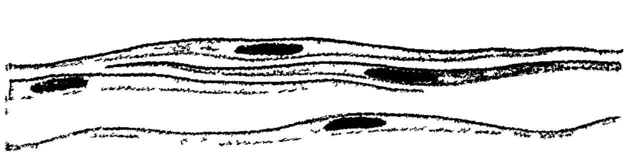
In the same muscle two fibers (top and bottom) can contract because of nerve impulses, as shown by arrows, while another fiber (middle) remains relaxed.

body. They form the "red meat" of red-blooded animals. Even when the skeletal muscles are at rest, some of their fibers are fully contracted. This condition is called *tonus,* or muscle tone. It keeps the body ready for action. Good muscle tone makes good posture.

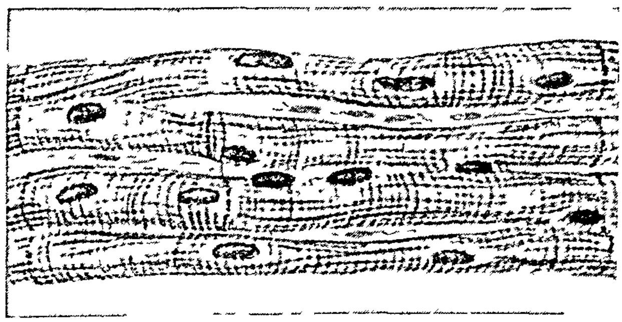
Under a microscope the fibers of the voluntary muscles show light and dark crosswise (circular) stripes. Hence, another name for them is *striped,* or *striated,* muscles. Each fiber also has many nuclei, which give it a speckled as well as a striped appearance.

The *involuntary* muscles work without our attempt to control them. They are found in the digestive canal, the blood vessels, the skin, the outlets of the glands, and in the various organs. All except the muscles of

TWO KINDS OF INVOLUNTARY MUSCLES



Under the microscope the fibers of most involuntary muscles look like these: spindle shaped, with an oval nucleus, and without stripes. These tiny fibers are found in body organs.



The fibers of heart muscle, shown above, consist of striped oblong cells joined end to end. They branch and reunite, forming an irregular network held together by connective tissue.

the heart have *smooth,* or *unstriped,* fibers. These are the second kind of muscles.

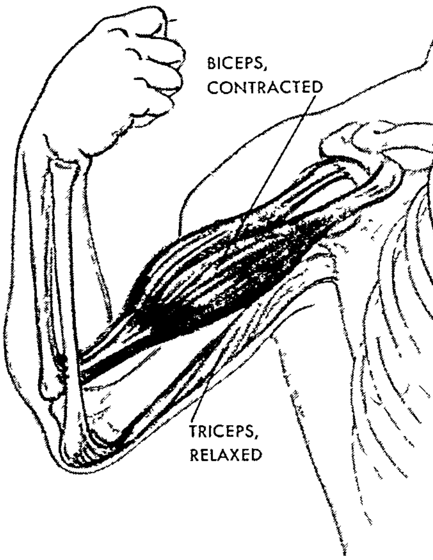
The heart, or *cardiac,* muscle is the third kind. Although it is involuntary, its fibers are partly striped. The fibers twist and branch to form two distinct masses of muscle. One mass makes up the auricles, the other the ventricles. The fibers in each mass are bound together with tough connective tissue. This forms a fibrous "skeleton" that gives the heart its shape. (*See also* Heart).

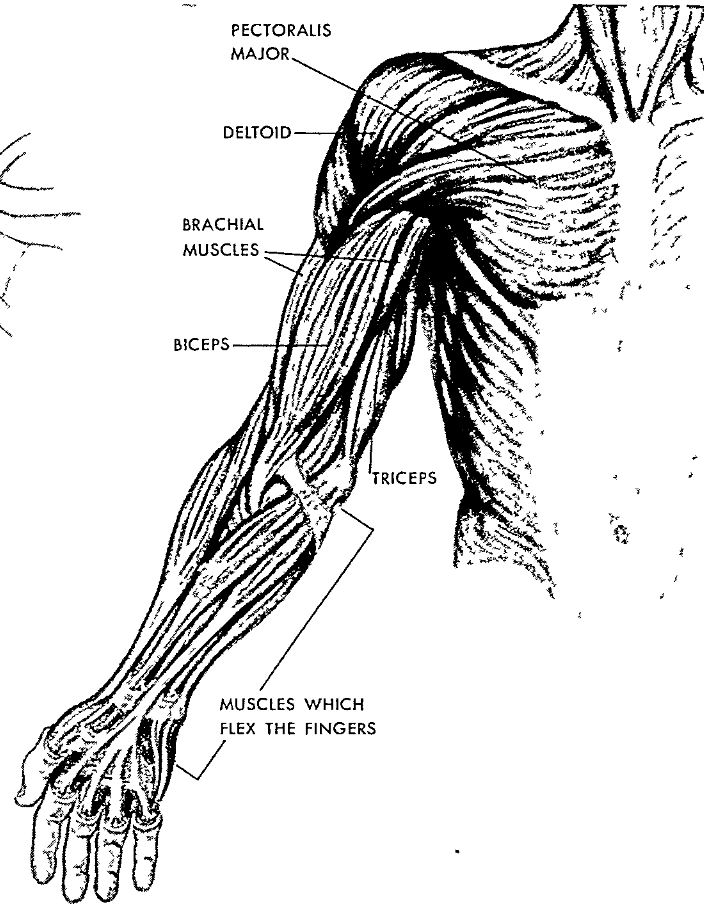
How the Muscles Work as a Team

Actually we do not control single muscles; we only produce movements. In each action, no matter how simple, a number of muscles come into play. As shown in the pictures on the following page, the biceps contracts as we bend our arm, but the triceps relaxes at the same time. Thus in any muscular action there is a *prime mover* that contracts and an *antagonist* that relaxes. Other muscles, as the shoulder muscles in this movement, are also involved. When these others hold a part or joint in place during the action, they are called *fixation* muscles.

These muscle teams can work together because there is a common nerve supply for related actions they perform. Thus we do not have to think of what each voluntary muscle should do. Certain actions, called

MUSCLES THAT MOVE THE BODY WORK IN TEAMS





Voluntary muscles are paired. Contraction of one member of a pair requires relaxation of the other member. The biceps and the triceps of the upper arm form a pair. When the arm bends at the elbow, as in the picture above, the biceps contracts and the triceps relaxes. When the arm straightens, as in the picture at the right, the triceps contracts and the biceps relaxes.

Even the simplest actions involve more than one pair of muscles. In the movements illustrated, shoulder muscles, such as the deltoid and the pectoralis major assist the action. The brachial muscles and the flexors of the fingers are also involved. Muscles which take part in related actions have a common nerve supply.

reflexes, work so fast that we do not have to think of what the entire muscle team should do (*see* Reflexes). Widely separated muscles in the body also work together to accomplish an associated action. For example, when we turn our head, our eyes also turn, the shoulders shift, the trunk muscles pivot, and even the feet may move. Damage to any one of these sets of muscles may damage or change our way of performing the whole action.

The human body has more than 500 muscles. Nearly all of them do special work. Thus when a surgeon transplants a muscle from one person to another to replace a disabled one, he selects a muscle that performs similar work and can take its place on the muscle team. The numerous muscles of the hand and wrist make both fine and coarse movements. The ability of the human hand to perform its variety of skills is one of the important physical differences between men and animals (*see* Hand).

Muscles develop and grow strong with use or get weak and flabby with disuse. Knotty, bulging muscles indicate great strength, but this strength can be applied only to certain limited physical tasks, such as weight-lifting. Men with such muscles are often "muscle-bound" and unable to move easily and swiftly. Good all-around athletes have long, rippling muscles that respond smoothly in graceful movement.

MUSES. Sometimes we say that "we have an inspiration." It seems almost as though some power outside ourselves made it possible for us to think, or speak, or write, or do something better than usual. The ancient Greeks believed that this inspiration came from the Muses—goddesses who presided over the arts and sciences. Their poets and musicians began important works with a prayer to one or more of the Muses.

Though the number varies in different accounts, these divinities were generally pictured as nine maidens, the daughters of Zeus, king of the gods, and Mnemosyne (Memory). When the gods gathered in festive assembly on Mount Olympus, the Muses were always present to furnish inspiration and entertainment. Led by Apollo they sang of the origin of the world, of gods and heroes, and celebrated the glorious deeds of Zeus (*see* Apollo). On earth many places were sacred to them, especially on Mounts Parnassus and Helicon. The word "museum" in its Greek form originally meant a temple sacred to the Muses.

Calliope, the most honored of the Muses, presided over epic or heroic poetry. Clio was the Muse of history, Euterpe of lyric poetry, Thalia of comedy and pastoral poetry, Melpomene of tragedy, Terpsichore of choral song and dance, Erato of love poetry, Polyhymnia of hymns, and Urania of astronomy.

Pale PLANTS *That* LIVE *on* OTHER PLANTS

MUSHROOMS. Many people used to look upon colorless plants as strange, unearthly things to be feared and avoided. Quaint superstitions grew up around mushrooms. Because some are deadly poison, they were said to be an ingredient in witches' brews. Toads sat on them—hence they are also called toadstools. Elves used them for umbrellas. Fairies danced by moonlight in the rings they formed. Any human who stepped inside the magic ring was bewitched.

Many different kinds of mushrooms grow in wet woods, in grassy pastures, and on well-kept lawns. They spring up with amazing rapidity during warm, moist summer nights and reach their full growth and decay in a very short time. Some live a few days, others only a few hours. Their colors and shapes are varied. They may be white, red, yellow, lavender, silvery blue, pink, or orange, but never green. The most familiar kinds look like little umbrellas. Others resemble golf balls, funnels, bells, stars, a nest of bird's eggs, a honeycomb, or a piece of coral.

Some kinds of mushrooms are delicious food. Others contain a poison so powerful that to eat them is almost certain death. People often call the poisonous ones toadstools. The botanist does not use this word. He simply speaks of edible and poisonous mushrooms. Hundreds of persons die every year from mistaking the poisonous for the edible varieties. Czar Alexis of Russia, who died in 1676, is said to have been among their victims. Emperor Nero once killed his guests at a banquet by feeding them poisonous mushrooms.

How Mushrooms Grow and Develop

Mushrooms are members of a large group of flowerless plants, the fungi (*see* Fungi). They contain no green coloring matter (chlorophyll) by means of which most other plants manufacture their food. Some obtain nourishment from decayed organic matter and are known as *saprophytes*. Others require food from living tissue and are therefore *parasites*.

The part of the mushroom plant which rises above the ground is only the fruiting body of the fungus. The growing, vegetative part lies under the ground in the form of a mass of dense white tangled threads, called *mycelium* or *spawn*. Mycelium grows year after year. It lies dormant in winter and in dry periods, becoming active in warm, moist conditions. From the mycelium the mushroom arises for its brief appearance. The mycelium may live for centuries.

The mushroom first appears above ground as a knob of tissue known as a "button." The button is covered with a membrane which breaks as the button grows. In some species the membrane remains as a cuplike structure (*volva*) around the base of the stem. In others it forms a ring or collar around the stem, below the cap. Shreds of it may hang from the margin of the cap or may be seen as patches on the top of the cap.

Under the cap of the umbrella-type mushrooms are radiating, platelike growths called gills. On each side of each gill the spores develop. These are very small one-celled organisms. Like the seeds of flowering plants, they are capable of producing new plants. When they are ripe they scatter with the wind. Settling in a favorable situation, one spore develops into new mycelium. (For a picture of a growing mushroom, *see* Spores.) Puffballs carry their spores inside the ball of tissue. When a mushroom dies it usually decays into a slimy mass, filled with insect larvae.

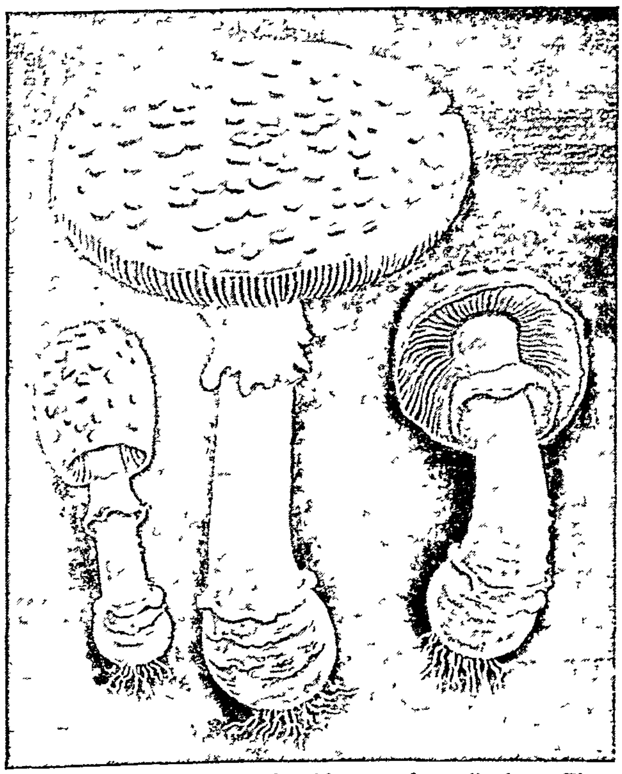
Fairy rings are formed in this way: A few spores fall in a warm, moist place and begin to grow. If the soil is of uniform composition and remains undisturbed for a long time, a circular patch of mycelium develops. After a few years mushrooms appear near the outer borders of the circle. As the mycelium uses up nourishment in the soil it spreads outward and mushrooms continue to appear around the rim. Rings as large as 50 feet across have been found. Botanists estimate them to be close to 400 years old.

Some Edible Mushrooms

If one intends to eat mushrooms it is necessary to recognize those that are absolutely safe and to avoid all others. A mushroom has very little food value so it does not pay to take the chance of death. A few general rules should be observed:

First, never collect young mushrooms. The button stages of the edible and poisonous kinds cannot be distinguished. Second, be sure in collecting to get the

DANGER SIGNALS OF THE DEADLY AMANITA



Four characteristics distinguish this genus from all others. First, the spores are white. Second, the gills are free from the stem. Third, there is a ring on the stem below the cap. Fourth, there is a cuplike structure at the base of the stem, called a volva. Many edible mushrooms have some of these characteristics, but only the dangerous amanita has all four in combination.

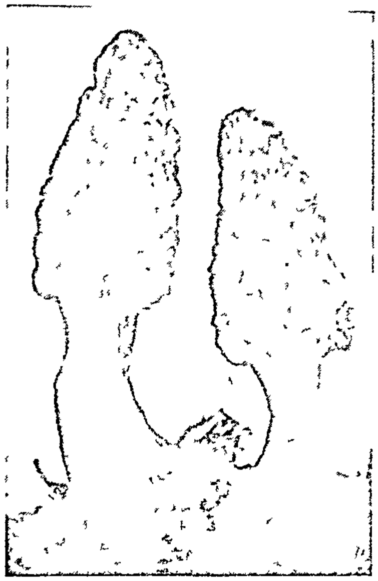
A COLORFUL COLLECTION OF MUSHROOMS

All these mushrooms are edible except the fly amanita. The coral clavaria and the parchment lactarius may have poisonous effects when immature or stale. Their scientific names are: shaggy pholiota, *Pholiota squarrosa* (1); puff ball, *Lycoperdon bovista* (2); dog mushroom, *Cortinarius caninus* (3); coral clavaria, *Clavaria coralloides* (4); red clavaria, *Clavaria rufescens* (5); violet clavaria, *Clavaria amethystina* (6); meadow mushroom, *Agaricus campestris* (7); parchment lactarius, *Lactarius pergamenus* (8); fly amanita, or fly mushroom, *Amanita muscaria* (9); common morel, *Morchella esculenta* (10); magpie mushroom, *Coprinus picaceus* (11); yellow chanterelle, *Cantharellus cibarius* (12). The painting is by Marshall Smith.

entire stem, including whatever part may be underground. The most poisonous species have a cup which is hidden beneath the soil. Third, avoid any with milky juices or with white or clay-colored spores. And fourth, do not eat an old mushroom whose cap has become brown.

In order to identify mushrooms correctly it is often desirable to make a spore print. Lay the cap on a sheet of paper. If you think the spores may be white place another cap on dark paper. Put a glass over the cap to exclude any draft and leave it undisturbed for 24 hours. Remove the glass and lift the cap carefully. The spores will have shed in the design of the radiating lines of the gills. If the spores are white the species is poisonous.

TWO FINE MORELS



Morels are among the most delicious of the edible fungi. They are cone-shaped and pitted like a sponge.

Many edible mushrooms are abundant and easily recognized. The common field mushroom (*Agaricus campestris*) is white with pinkish-brown gills. It is umbrella shaped, stocky, and solid. These are the mushrooms usually sold in grocery stores. Many people make a business of raising them. They are grown on trays in special sheds where temperature and moisture are carefully controlled. Nearly complete darkness usually produces the best results. Hence they are often cultivated in damp basements, caves, and abandoned mines.

Puffballs are large, white, stemless knobs. The giant puffball (*Calvatia maxima*) sometimes reaches a diameter of three feet. Other members of the genus Lycoperdon are also very abundant in pastures and open fields. Puffballs are good to eat only if the "meat" is white and solid. They must never be collected until they reach full size because there is danger of confusing them with the button stage of poisonous species. Anyone who has kicked a ripe puffball and watched the cloud of dust burst out knows how the puffball gets its name. The dust is composed of billions of dark-brown spores. (For a picture of a bursting puffball, *see* Plant Life.)

Morels (*Morchella esculenta*) are considered the choicest of all the mushrooms. Many attempts have been made to raise them commercially but without success. They grow in moist woods in early spring. The cone-shaped caps, three to four inches high, are deeply pitted, resembling a sponge. The stem is white, the cap and cells creamy tan.

Related to morels are the truffles, highly prized in Europe. They are tuberlike growths (genus *Tuber*) remaining entirely underground a foot or so below the surface. Dogs and pigs are trained to hunt them by scent. They are little known in North America, although they grow from coast to coast.

Shaggy-manes (*coprinus comatus*) have cylindrical caps, four to six inches high, white, covered with ragged brownish tufts. Their spores are black. They have a curious way of freeing them. The gills liquefy from the bottom of the cap upward, and the spores mature and blow away just ahead of the liquefied area. These mushrooms must be gathered just before they mature and should be cooked immediately.

The sulphur polypore (*Polyporus sulphureus*) grows on rotten logs and on the trunks of living trees. It is orange or sulphur yellow and grows in overlapping, fan-shaped shelves four to ten inches deep. It matures in the fall.

Clavarias grow upright in finger-like masses. Among the dark trees of the forest they look like clumps of pale yellow or white coral. Another prized mushroom is the chanterelle (*Cantharellus cibarius*). The cap is a deep rich yellow, with an irregular crumpled margin. It is depressed at the center, which gives it the name "chanterelle," meaning "little cup."

Poisonous Mushrooms

Two dangerous species of mushrooms are common in North America—the deadly amanita, also called "death cup" and "destroying angel," and the fly amanita. Deadly amanita (*Amanita phalloides*) has a cap two to six inches wide. It is a pale grayish-brown color near the center but white on the margin. The young cap is convex. Later it slopes downward from the center toward the margin and looks like an inverted saucer. The volva is concealed underground. The ring on the stem and the warty patches on the cap soon disappear, so that these three warning signals are not evident in the older mushrooms. One can see, however, that the gills do not touch the stem and that the spores are white. Its poison is *phallin*, which dissolves the blood corpuscles.

Fly amanita (*Amanita muscaria*) is one of the largest and most beautiful of the mushrooms. Specimens a foot tall with caps nearly a foot across are common. The color of the cap is straw-yellow to reddish orange. The surface is spotted with white or pale-yellow warts. The gills are white or pale yellow. Its poison, extracted by steeping in milk, was used to kill flies. The poison is *muscarine*.

Jack-o'-lanterns (*Clitocybe illudens*) are bright orange-yellow, growing in clumps on a stump or log in the woods. They are luminescent. On rainy nights they glow through the dark forest in a most eerie manner. If eaten they will cause violent illness; however, they are not considered deadly.

Many mushrooms belong to the class *Basidiomycetes* (*see* Fungi), which includes also the rusts and smuts. Most edible mushrooms are members of this group. Morels and truffles belong to the class *Ascomycetes* and are closely related to the mildews and yeasts.

ORIGIN *and* GROWTH *of* MUSIC—"*The* UNIVERSAL ART"

Music teachers find that they can easily teach young children rhythm with the tin pan band. For this purpose, drumsticks and simple kitchenware, such as tin kettles, are the most satisfactory instruments.

MUSIC. Some of the oldest fables tell us of the power of music. The ancient Greek hero Orpheus is said to have charmed the very trees and stones with the music of his lyre. So powerfully does it affect the emotions that it was thought to be the product of inspiration. This belief is seen in the origin of our word "music", for it comes from a Greek word which means "the art of the Muses"—the mythological goddesses of inspiration (*see* Muses). Music more than any other pursuit offers us an opportunity to get away from the ordinary things of life. In proportion as we understand great music, we are lifted out of ourselves into an ideal realm.

If you wish to understand such music as that of Bach, or indeed any great music, you must not try to *explain* it, for it has no "subject." It is not "about" anything. If music were to attempt to deal with the subject matter of Dickens' 'The Tale of Two Cities', or of Da Vinci's 'The Last Supper', it could only express the emotions roused in the composer by the subjects. But such is the power of music that we get from it what no other art can give us; rather, it deals with those things that are the *basis* of all the other arts. Both Dickens and Leonardo da Vinci were seeking the truth that underlies the exterior of what they portrayed.

The first music was undoubtedly singing—the spontaneous expression of emotion in which speech blended with song. The first songs of which we have record are those of savage peoples; they are vivid in rhythm, though monotonous in melody, as illustrated by a primitive Australian song. The song consists of only one short phrase, sung over and over again to accompany dancing (Fig. 1).

Of the three elements of music—rhythm, melody, and harmony—the first to develop was rhythm. It is not only the beginning of music but also its most important element. When we listen to a march, we feel its rhythm and we may even try to keep time with hand or foot. This feeling is remarkably developed in uncivilized peoples, who lead an active outdoor life. In parts of Africa, for example, children can beat four with one hand while beating three with the other, and they can move one foot six times while moving the other twice. Some of these complex rhythms are employed in our modern "jazz" music. As music grew, its rhythms made more logical and satisfying patterns, and the melodies became more varied and more beautiful. With this primitive music, rude instruments were doubtless used, especially those of the drum family.

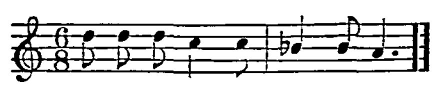



Fig. 1 Primitive Australian Song

Just as we have our favorite songs today, so in early times members of a group or tribe probably selected from the large number of primitive songs certain ones that they especially liked, and these were handed down from generation to generation. As people became more settled in their habits, and more thoughtful, they made up songs while they worked or played. In course of time, these became less monotonous and took on real beauty. Some of these

NOTE: It is recommended that, so far as possible, the musical examples given herein, or referred to, be played or sung by the reader. It would be especially valuable and interesting if a group should try some of the music written for group singing. Simple compositions suitable for that purpose are suggested. Music notation, being merely a symbol of the sounds, means nothing unless the sounds are realized either through the eye and inward ear together (that is, by *looking* at the notation and *hearing* the sounds without actually producing them), or by actual sounds through playing or singing.

"folk-songs," as they are called, were the basis for a part of the great music of the 18th and 19th centuries. Most folk-songs are constructed according to a principle often used in modern music. This form is *a, b, a, b;* each letter represents four measures of the song, as for example in 'Old Folks at Home'.

PRIMITIVE MUSIC WITH DRUMS AND MARIMBA

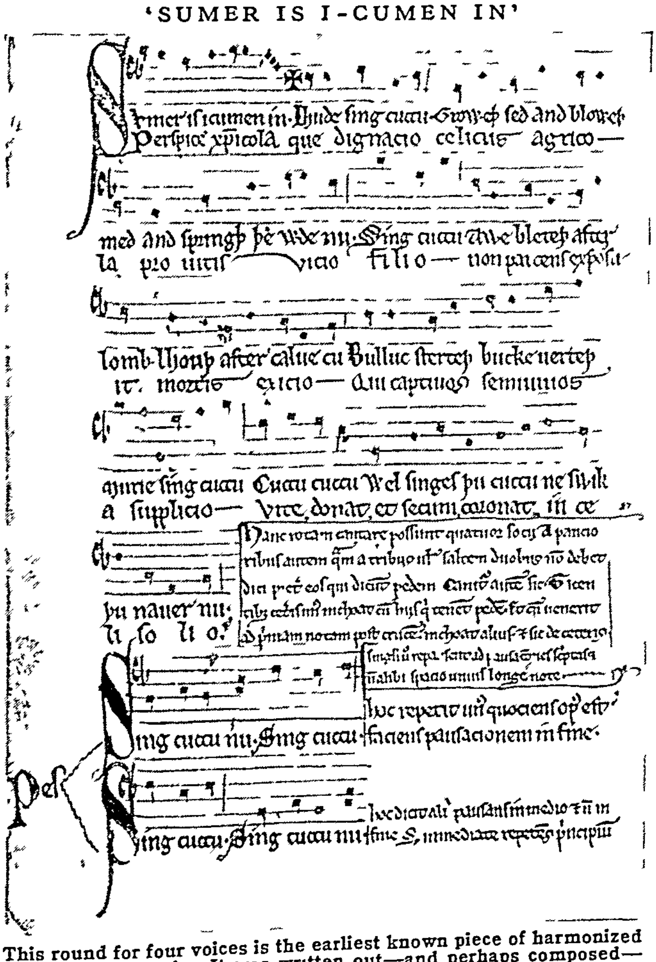
These natives of the Cameroons in Africa are producing a primitive form of "jazz," by beating drums with their hands while one plays a tune on the marimba—"the African piano"—which consists of wooden slats with resonating gourds.

Jewish and Greek Music

Folk-songs were used in relation to religion as well as to everyday life. Many of the old hymn tunes originated in much the same way as did the songs of work or play; that is, from a desire for spontaneous expression through a medium more emotional than words alone could be. Some religious melodies came from secular sources. The headings of many of the Psalms indicate how important music was in the Old Testament. Psalm xxii, for example, is entitled 'To the Chief Musician upon Aijeleth Shahar'.

The Greeks valued music chiefly from the standpoint of its effect on character; some believed that music apart from words was useless or even harmful. They sang only in unison, or in octaves, and evidently had no knowledge of harmony. For notation they used the letters of the alphabet written above the syllables of the words. The Greeks had a system of scales, each one having a name of its own, as Dorian, Phrygian, etc. You can play some of these on the piano by using only the white keys, beginning successively on A, C, D, E, F, and G.

'SUMER IS I-CUMEN IN'



This round for four voices is the earliest known piece of harmonized secular vocal music. It was written out—and perhaps composed—about 1240 by John of Fornsete, a monk of Reading Abbey, England.

Meanwhile, instruments had been invented and improved. The Greeks used various forms of the lyre or harp, and the flute, as well as the trumpet. The Jews used trumpets, pipes, cornets, and cymbals, as well as harps, psalteries, and other stringed instruments. In some of their religious ceremonies, they employed great numbers of players and singers. They had, however, as far as we know, no musical notation; the melodies were all memorized, and were sung in unison or in octaves without any harmony.

Great Christian Church Composers

Christian music bears traces of both Greek and Jewish influences. From the Greeks it took the system of scales; and from the Jews the chanted music of the Psalms. The priests sang the greater part of the service and the people sang only the hymns. A large number of hymns appeared during the 4th and 5th centuries, but there is no certain record of any hymn tune earlier than the 10th century. In the 4th century, St. Ambrose organized certain scales for use in Christian worship. This work was continued at the end of the 6th century by Pope Gregory; hence we speak of Gregorian chants, which are still much used in religious services.

Beginning of Polyphonic Music

For many centuries all singing was in unison or in octaves, and it was an important step in advance when two or more independent parts, or "voices," were

used at the same time. No one has learned when this began, but we have specimens of part-writing which date as far back as the 9th century. This music sounds strange to us, for it used successions of "fourths," such as C-F (sounded together) followed by D-G, or "fifths," such as C-G followed by D-A; whereas today our ears are accustomed to "thirds," such as C-E followed by D-F. As time went on, part-writing developed. Composers became skilful in combining several parts, each like a thread in a beautiful pattern. Such music is called "polyphonic" (many-voiced). It involves two elements: counterpoint, which is the art of making each part melodious; and harmony, which is concerned with the beauty and logical progression of the chords.

Church music reached its height with Palestrina (Italian, 1524?–1594). Other great composers of church music in the 15th and 16th centuries were Joannes Okeghem (Netherlands); Josquin Deprès (French); Orlando di Lasso (Netherlands); William Byrd (English); Thomas Morley (English); Michael Praetorius (German); and Thomas Weelkes (English).

This church music carefully avoided marked rhythms, since such rhythms are based on dancing. In the quotation (Fig. 2) from 'Ave, Verum Corpus', by Deprès, you may note not only the absence of a strong rhythm, but also the imitations among the different voice parts, which are indicated by brackets.

Fig. 2. From 'Ave, Verum Corpus', by Deprès

Development of Early Secular Music

The greatest musicians of those days wrote for the church, but there was also much valuable work in the secular field. The people of every region in Europe had their folk-songs, and during the Middle Ages wandering singers—called *troubadours* in southern France, Italy, and England, *trouvères* in northern France, and *minnesinger* in Germany—roamed from castle to castle singing songs of chivalry and courtly life; while the *jongleurs* delighted the common people. The German musicians organized themselves into guilds (*see* Guilds), and established schools. Competitions were held periodically and the successful candidates were acclaimed *meistersinger*, or master singers (*see* Opera: 'Die Meistersinger'). In Wales, an organization of singers known as the *eisteddfod*, or congress of bards, dating back long before the Christian era, assumed its present form during the 4th century, and continues to the present day.

The earliest surviving example of secular part-writing, 'Sumer is i-cumen in' (Summer has come in), is believed to have been written about 1240 by an English monk, John of Fornsete. This is called a "canon" or "round," a type of composition in which each part has exactly the same tune, but enters separately, delayed perhaps by one measure or two. It also has a definite "ground bass"; that is, a set part or figure, which is repeated all through the piece and is not a real tune in itself. Presently the methods of polyphonic writing developed for church use were employed for secular music in what were called "madrigals." These are part-songs with lively dancing rhythms and emphatically developed individual melodies for each voice.

Along with these new interests in vocal music, instrumental music also made remarkable progress. Every gentleman was supposed to be able to play the lute (a guitar-like instrument), and the favorite instrument for ladies was the virginal, or small harpsichord. Violins were perfected, organs were greatly improved, and several other instruments of the keyboard type came into popular use (*see* Musical Instruments; Organ; Piano; Violin). These were used at first, singly or in combination, to accompany singers. Composers then saw the possibility of using them independently, and began to write for them alone.

The 16th century was a glorious period in music, as it was in geographical discovery, and in literature and the other arts (*see* Renaissance). It brought to perfection the liturgical forms of church music (masses and motets), and as a result of the Reformation it saw a vast enlargement of the popular forms of church music (hymns and chorales), especially in Germany, home of the Reformation. Martin Luther himself wrote both words and music of many hymns and chorales. It was followed by daring experiments in the freer use of harmony, by the further development of musical instruments, the rise of a new kind of music

written for the solo singer, and the beginnings of opera (*see* Opera). Thus the story of music moves toward its modern period, marked by the great work of Bach and Handel. Just before the dawn of the new period, the English composer Henry Purcell (1658–1695) wrote noteworthy compositions in the polyphonic form for both voices and instruments, that were full of rhythmic life and harmony.

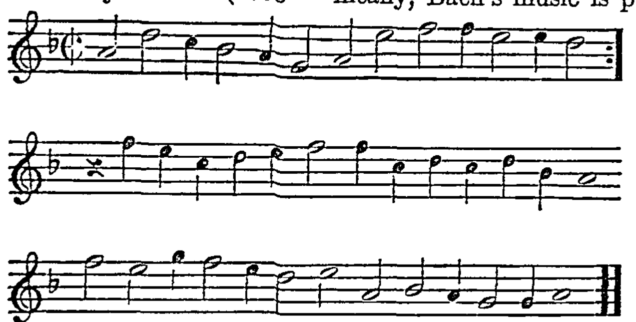


Fig. 3. Melody of Song by Hassler

Music in the 17th and 18th Centuries

Composers were at work in the 17th and early 18th *centuries on musical forms* that offered new opportunities for the voice and the instruments. They wrote solo songs (much more elaborate than their forerunners, the folk-songs), part-songs, and operas, and also music for pageants and miracle-plays. Virtuosity in playing musical instruments was notably developed. Among the new instrumental forms created were the *suite*, a group of dance tunes; the *rondo*, which had a theme that recurred in its original key at certain intervals; and the *sonata*, the greatest of all musical forms.

Among the great musicians of the time were Alessandro and Domenico Scarlatti, Corelli, and Tartini in Italy; and Lully, François Couperin, and Rameau in France. Even more significant than the work of these composers was the gradual adoption of our major and minor scales. As a result, changes from one key to another, called *modulation*, could be made, and great richness in harmony was gained.

The 18th century was distinguished by the genius of some of the greatest masters of the art. Many composers were at work in Germany, notably Johann Sebastian Bach and George Frederick Handel. Technically, Bach's music is polyphonic with free use of vivid rhythms. He wrote in nearly all forms, both instrumental and vocal, except opera. His music, which reflects religious devotion and feeling, is distinctly a product of the Reformation. The chorale, a religious chorus, is its chief basis, though he *sometimes drew his* themes from secular sources. The best example of this is, 'Oh, Sacred Head, Now Wounded', which was originally a love song by Hans Leo Hassler (Fig. 3). Bach used this tune many times in his compositions. An interesting example is found in a chorale at the close of the 'St. Matthew Passion' (Fig. 4).

Chorales serve as the foundation for many of Bach's vocal works, particularly the 'St. Matthew Passion', the 'St. John Passion', and his cantatas. Usually they were merely familiar hymn tunes of the period rewritten in polyphonic style. His greatest choral work is the 'Mass in B minor'. Bach's suites usually contained four distinct dances, almost always in the same key. Among his great songs, 'My Heart Ever Faithful' is one of the most celebrated. His best-known instrumental work, 'The Well-Tempered Clavichord', is a set of preludes and fugues in every key. *"Well-tempered" means the system of tuning*

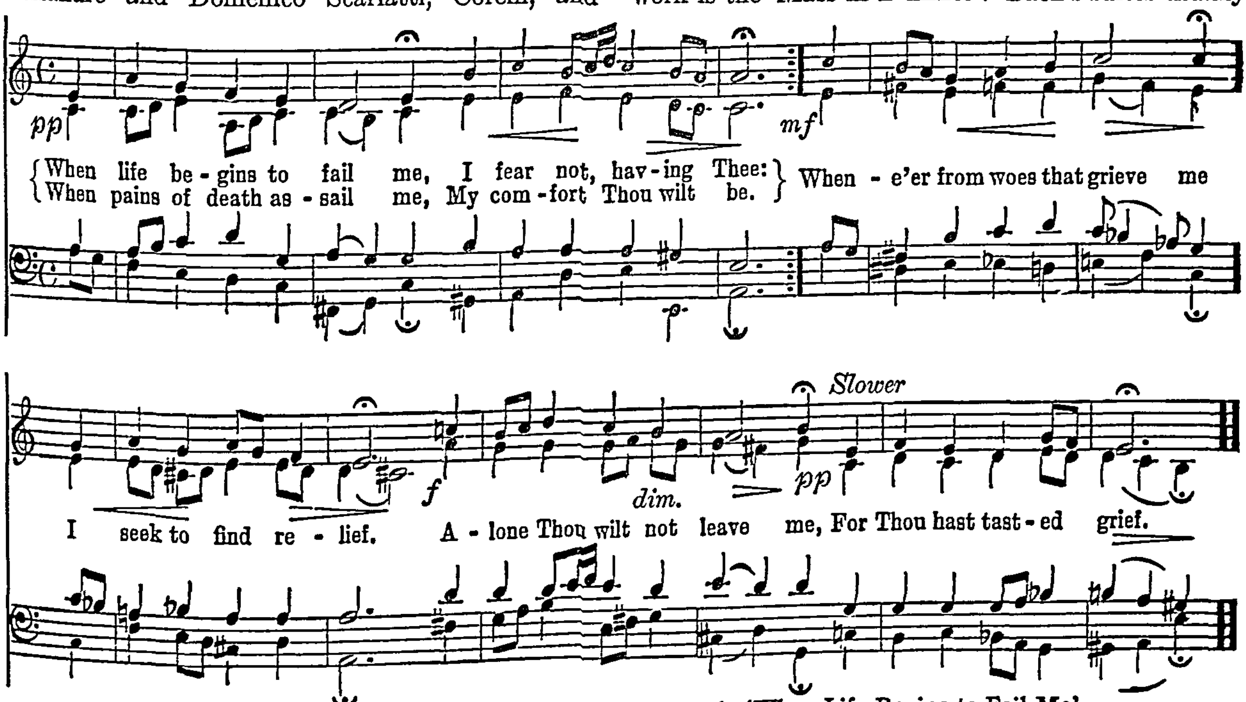


Fig. 4. Bach's Use of the Hassler Song in the Chorale 'When Life Begins to Fail Me'

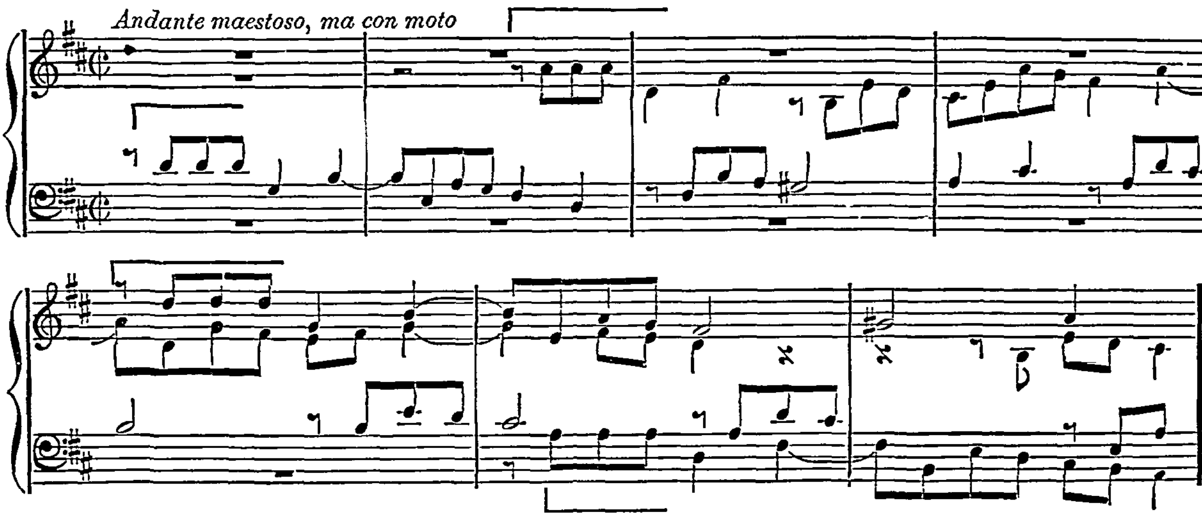



Fig. 5. From a Fugue by Bach. Brackets Indicate Entrance of the Four Voices

perfected by Bach, which allows free modulation from one key to another (*see* Piano). Bach perfected the *fugue*, a highly developed canon or round. In this form, the "voices" enter in succession as in a round, but when the first voice has gone through its part, it does not repeat itself, as in a round; rather, it comments, as it were, on what it has already said while the second voice gives out the original theme; and thus the piece continues until all four have entered.

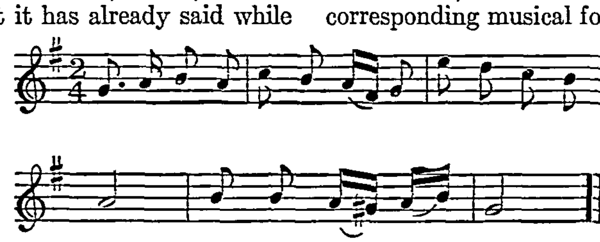


Fig. 6. Croatian Folk-Song

In the first part of Fugue No. 5, Vol. II, 'Well-Tempered Clavichord', as given in Fig. 5, the entrances of the four voices are indicated by brackets. If you study the entire piece, you will observe that there is not a note in it, except for two quick notes in the ninth measure, that does not come from the first two measures. Bach's themes are, for the most part, serious; but they express a wide range of human feeling and never lose their interest, no matter how often you hear them.

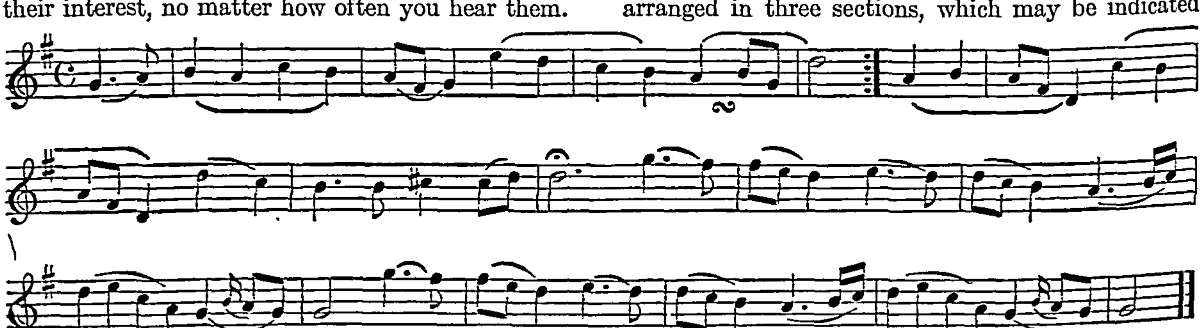



Fig. 7. Haydn's Use of the Folk-Song in the 'Austrian Hymn'

Handel is particularly noteworthy for his fund of pure melody, his skill in polyphony, and his capacity for building up great massive choral effects. His work is more easily understood than that of Bach, chiefly because it is simpler and more melodious. He wrote in all the chief forms, especially opera and oratorio.

This period marks an important stage in the development of the *sonata*, the most significant musical form. It is written for a solo instrument or for two instruments, such as the piano and the violin. The corresponding musical form for an orchestra is called the *symphony;* for a solo instrument accompanied by other instruments it is a *concerto.* Karl Philipp Emanuel Bach, the second and most talented son of J. S. Bach, is an important figure in the development of this form, since he created for it a first movement, well illustrated in his Piano Sonata in F minor.

The symphony received its greatest impetus from Franz Joseph Haydn. He composed 125 works in this form. A symphony, like a sonata, is written in four parts or movements. The first is fast and arranged in three sections, which may be indicated by the letters *a, b, a.* All the themes, or melodies, are introduced in the first, or *a*, part. The next, *b*, contains the development of these themes. Like the plot of a novel, it runs through various keys and is

full of action; *a* again repeats the material of the first part with certain modifications. A second movement usually follows in slow time, like a song, and contains two or three sections. Each has its own theme and all are in a quiet mood. Next comes, as a rule, a lighter movement—a scherzo or a minuet—also in *a*, *b*, *a* form. The finale or last movement is often a rapidly moving rondo, with one theme which occurs two or three times with contrasting sections. Thus the symphony deals with great musical masses, each unit of which constitutes a necessary part of the whole design.

Haydn had only a small orchestra at his disposal. It contained flutes, oboes, bassoons, trumpets, horns, trombones, and drums, in addition to the stringed instruments—by that time settled into our present grouping of violins, violas, violoncellos, and double basses. His melodies are always simple and direct. In his work, for the first time, folk-music takes its place frankly as a part of composition. Most of his instrumental music is based on folk-songs and dance tunes. The String Quartet in C major is a fine example of Haydn's chamber music; the slow movement contains the well-known 'Austrian Hymn' based on a Croatian folk-song. A comparison of them reveals the interesting changes that he made in the folk-tune (Figs. 6 and 7).

Mozart's Classic Purity

Mozart's is one of the greatest names in all music. He was accustomed to court life, and his music has little of the peasant quality found in that of Haydn. He wrote in all the then known forms of music, but is chiefly famous for his operas ('The Magic Flute', 'Don Giovanni', and 'The Marriage of Figaro'), for his symphonies, and for his chamber music—compositions for a small number of instruments, of which the string quartet is the best known. His symphonies and string quartets are even more beautiful than those of Haydn. His themes are simple but not rustic, and the greatness of his music lies in its classic purity and skilful use of counterpoint. It is like a finely cut cameo, every line clear, every value perfect. To us, accustomed to more complex music, it may sound too simple, but we should not be deceived. He brought the symphony and kindred forms to such a point of perfection that again the art had to search out new paths, as it did after the time of Palestrina. In Mozart's symphonies the clarinet is used for the first time. He did not use the piano, so far as we know.

The harpsichord and other early instruments of the piano type could not sustain tone adequately; and in consequence, Mozart and other composers for such instruments ornamented their music with runs, turns, and trills. Chords in the left hand were broken, so that one note would sound after another to maintain the tone. During the century before Haydn and Mozart, the liking for harmonic effects had been steadily growing; yet, even in the music of these two great composers, chords were quite simple and dissonances were few.

Beethoven and the Romanticists

Beethoven, who is considered by many to be the greatest of all composers, expanded the sonata, symphony, and kindred forms, and brought music from the courts and cloisters into the realm of common life. His music throbs with human feeling, guided by a noble mind. He wrote in many moods—tragic, tender and playful, humorous and serious. In contrast to those who preceded him, his plan was larger, his themes more vital, and his dissonances sharper (Fig. 8). During Beethoven's lifetime, the Napoleonic Wars were devastating Europe. A great intellectual upheaval was taking place, and this was reflected in Beethoven's work. His music represents another step forward, such as those that occurred successively after Palestrina, after Bach, and after Mozart, when a method of expression had been perfected and a new one had to be found.

Franz Schubert occupies, in the opinion of many persons, the supreme place among creators of beautiful melodies. They have perfection of proportion, clearness, and tunefulness. He wrote over 600 songs, many of which are masterpieces. His time was the beginning of the Romantic Period, when new ideas and new forms were appearing in art and literature. The full flood of romanticism in music did not come until the work of Schumann, but Schubert was of the same world. In addition to his many songs, he wrote symphonies, chamber music, masses, operas, and piano pieces in great numbers. He was limited, however, by the fact that he never mastered the art of counterpoint.

Robert Schumann brought romanticism to full flower. Romantic expression, as we find it in Schumann's music, is marked by a less formal style; in the absence, therefore, of conventional passages; in the clouding of outlines; and above all in the expression of quickly changing moods. He is at his best either

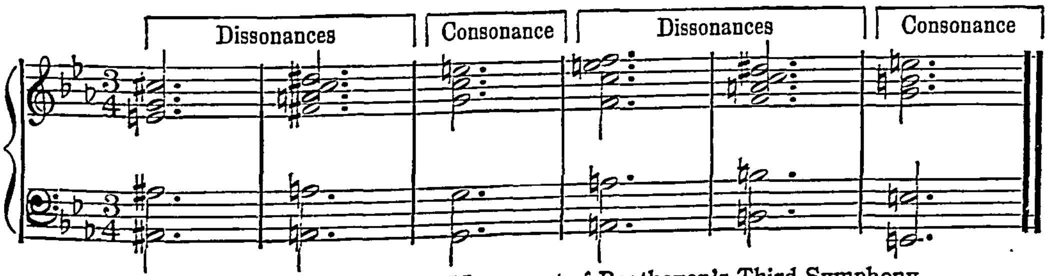


Fig. 8. Chords from the First Movement of Beethoven's Third Symphony

in short compositions or in those where changes of tempo, of theme, and of mood take place constantly. He was not, however, a painter of miniatures; his style is much too free. He is more like an impressionist in painting (*see* Painting).

In Schumann's music, we meet almost for the first time fanciful titles, such as "romance" and "nocturne." In a series of short pieces for his children, he gave each a name as a guide to the mood; for music

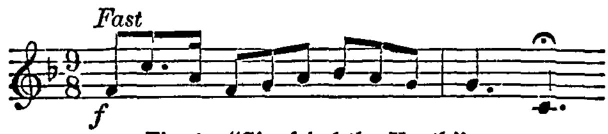



Fig. 9. "Siegfried the Youth"

cannot describe; it can only suggest. His charming songs and compositions for the piano represent his highest achievements, though he wrote in almost every musical form.

Felix Mendelssohn, a contemporary of Schumann, was better known, chiefly because his compositions were more easily understood, since they were more straightforward and simple. His work is not as stimulating and suggestive as that of Schumann, yet he composed much beautiful music in all forms. Most famous are the oratorio 'Elijah', the incidental music to Shakespeare's play 'Midsummer Night's Dream' (from which comes the widely popular 'Wedding March'), and his violin concerto.

Frédéric Chopin who was born in Poland, understood how to write for the piano better than any other composer. He makes it sing like an orchestra, and by the use of the damper pedal spreads out chords so widely that the whole instrument is awakened, as for example in the second part of the 'Funeral March'. He established a new technique in composing for the piano by elaborating melodies with sparkling figures, quick scales, and arpeggios. He was a great virtuoso, and charmed everyone who heard his play-

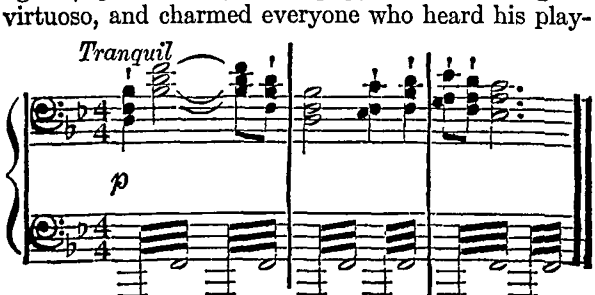


Fig. 10. "Siegfried the Man"

ing. He was little influenced by other composers, and he did not greatly affect the development of the art.

During this period of glorious instrumental music opera flourished. Following the great compositions of Mozart in this field, came a galaxy of writers, including von Weber, Rossini, Donizetti, Bellini, Mascagni, Verdi, Puccini, and Bizet. (*See* Opera.)

This period is notable also because of Liszt, famous chiefly as a pianist and as a champion of Wagner; Berlioz, great master of orchestration; and Robert Franz, distinguished for the beauty of his songs.

Wagner and the Music Drama

In Germany, Richard Wagner revolutionized the opera, chiefly by making the music answer the demands of the play and by creating *leit-motifs*, or leading themes, expressive of the characteristics of his stage personages, as well as of the underlying emotions of every moment in the play. He has a motif for Wotan, the god, and for Siegfried, the fearless hero, as well as for Mime's fear and Brünnhilde's love. He also made the orchestra into a sort of commentator in the action by giving it themes of its own; for example, themes that reveal what is in the hearts and the minds of the characters. He developed the leit-motifs as the characters developed in the progress of the drama. The motif for young Siegfried before his great adventure

Fig. 11. "Siegfried's Death"

against fate is expressed as in Fig. 9. After he has pierced the flames and won Brünnhilde, the motif changes (Fig. 10). When Siegfried has been slain, the motif is expressed in the form shown in Fig. 11. Of Wagner, it has been well said that he had "the power, which he shares with Bach and Beethoven alone, of coining brief memorable phrases, not formal enough to be called melodies, but so striking and incisive that once heard they cannot be forgotten."

The "Three B's"

Johannes Brahms is often referred to, with Bach and Beethoven, as one of the "three B's"—the master composers of all time. In general, he combined romantic expression, such as first appeared fully in Schumann, with classic form. He could manage large musical designs with great skill; indeed, he was the first composer after Beethoven capable of writing a symphony with complete command of all the necessary material. When his four symphonies first appeared, they were considered dry and academic, because people had become accustomed to the glow of the romantic school. Now it is recognized that Brahms' themes are full of beauty and even of sentiment, although it is restrained. Among his finest compositions are the three quartets for piano, viola, and cello. In his series of intermezzi for the piano, the one in E flat minor is thought by many musicians to be the finest short piece for the piano since Bach.

Other contemporaries of Brahms were enriching music by much noteworthy work. Humperdinck,

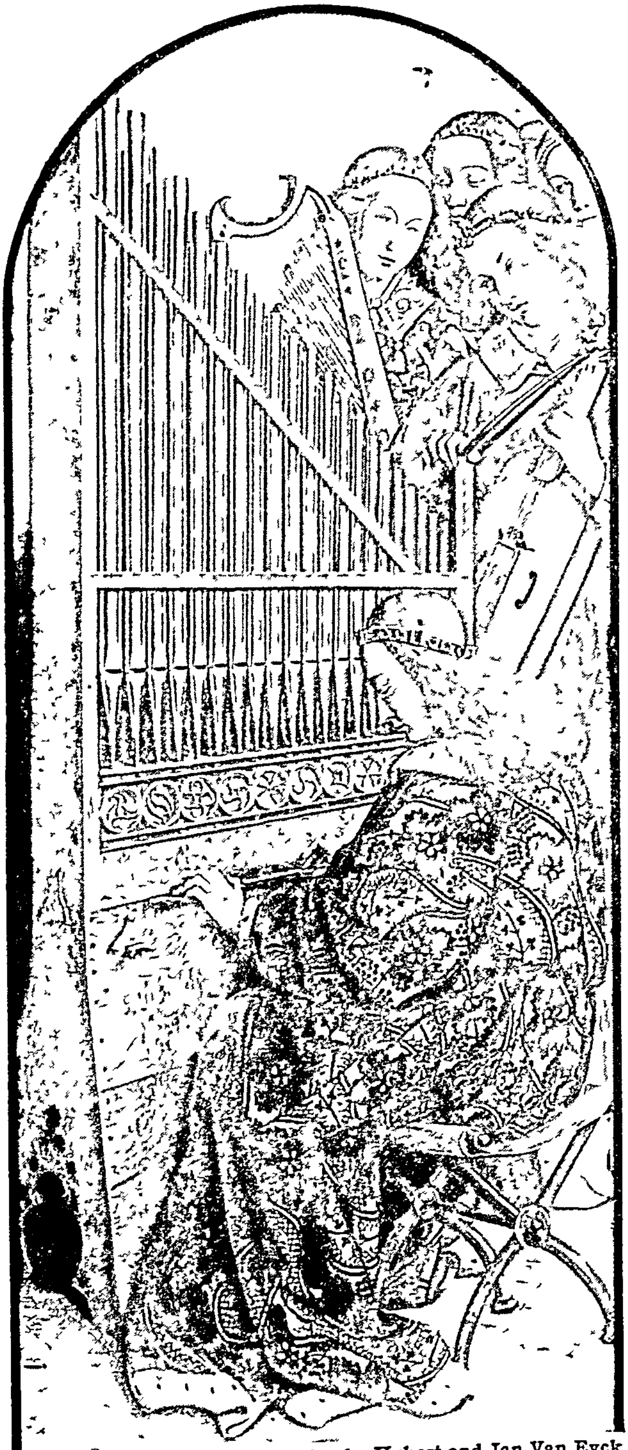
assistant to Wagner at Bayreuth, is well known for his opera 'Hänsel and Gretel'. César Franck, organist and teacher for many years in Paris, is at his best in contemplative mood. He wrote a group of masterpieces in the last ten years of his life: a quintet for piano and strings, a violin sonata, a string quartet, a symphony, and a group of beautiful piano compositions.

Among outstanding Russian composers is Peter Ilyitch Tschaikovsky, famous for his six great symphonies, of which the last, the 'Pathétique', is the best known. He was a soul-sick man, never long happy, although successful and widely known. This condition is expressed in his music, which is never happy, but animated by vigorous and even wild energy, by sentiment, mostly sorrowful, and by occasional tenderness. It has at times great eloquence and fairly sweeps us off our feet by its tumult. His most famous followers were Modest Moussorgsky, whose most popular work is 'Boris Godunov'; and Nicholas Rimsky-Korsakov, who wrote a charming fairy tale for the orchestra called 'Scheherazade'.

The great Bohemian musical composer and conductor, Antonin Dvořák, is noted chiefly for his 'New World Symphony', composed while he was in New York City. He was of peasant stock, and his music is rich in folk-idiom, as was that of Haydn.

The work of the Norwegian composer Edvard Grieg is characterized by its distinctly national idiom. His music is in the folk-song style, and is at its best in the short forms, such as the 'Peer Gynt' suites, and in his extraordinarily beautiful songs.

A FIFTEENTH-CENTURY ORGAN



The angels in this famous painting by Hubert and Jan Van Eyck (1420) are playing a "positive" (portable) organ, a harp, and a violin. This is a panel from the Ghent altar-piece, 'The Adoration of the Lamb'.

Hugo Wolf, in Austria, carried still further the development of expressiveness in songs. His music succeeds amazingly in setting forth the constant changes of meaning and feeling in the text. In Germany, Richard Strauss gained renown through his operas 'Electra', 'Salome', and 'Der Rosenkavalier', his symphonic poems, and his songs. The symphonic poem is like a condensed symphony all in one movement, and usually suggestive of a particular subject.

French music has always been distinguished for clarity of expression and restraint in sentiment. These qualities may be observed in the work of Claude Debussy. He moves chords with great freedom, and often uses the "whole-tone" scale: C, D, E, F sharp, G sharp, A sharp, B sharp, and D. His melodies are elusive and delicate, and he makes the orchestra sound sometimes like a magical harp, and sometimes like an organ in a great cathedral. His opera 'Pelléas et Mélisande' is famous the world over. Its characters intone a sort of song-speech, which the orchestra illuminates with colorful sound. His most famous piece for the orchestra is 'L'Après-midi d'un Faune'. Maurice Ravel is chiefly known by his ballet 'Daphnis et Chloé', his 'Valses nobles et sentimentales', and his 'Bolero' for orchestra. Saint-Saëns is distinguished for his symphonic poems and his operas, of which 'Samson et Delilah' is best known. Charpentier composed the beautiful opera 'Louise'.

Jean Sibelius of Finland has achieved distinction as a symphonic composer. His music reveals the vigor and wildness of his native land. The symphonic poem 'Finlandia' is his best-known orchestral work.

For some time after Purcell, English music made no marked progress. Sir Charles Hubert Parry and Sir Charles Villiers Stanford began a revival which is still in progress. The comic operas of Sir Arthur S. Sullivan (for which Sir William S. Gilbert wrote the words) are full of tunefulness and interesting humor. Frederick Delius has written distinctively original pieces for orchestra and chorus. Sir Edward Elgar is known chiefly for his 'Enigma Variations' for orchestra, and his oratorio, 'The Dream of Gerontius'. In 'The Hymn of Jesus', a choral, and 'The Planets', an orchestral suite, Gustav Holst has shown a diversified talent. Ralph Vaughan-Williams has revived the English folk-song idiom and written symphonies and many choral works of a high order. Experimenting in new forms, Granville Bantock has produced choral and orchestral works rich in tone and feeling. In his songs and piano compositions, Arnold Bax strikes a note of mysticism.

New ideals and new methods are reflected in the work of many composers of today. Stravinsky, a Russian, is probably the best known. His 'Le Sacré du Printemps' has been widely performed. Malipiero in Italy, Bartok in Hungary, Schönberg in Austria, Scriabine in Russia, and De Falla in Spain, have all contributed to the advance of the art, especially by the free use of dissonances. Some of this new music is difficult to understand and ugly to ears unfamiliar with the new idiom. So, to untrained eyes, are the paintings of ultra-modern artists. We should not condemn a work of art we do not understand, but should either pass it by altogether as not for us or wait patiently for its meaning to be revealed to us by later developments.

Music in America

Up to the last few decades, the United States had been too busy felling trees, building homes, and pushing its frontier westward to give much attention to music. The musical interests of the Pilgrims naturally centered about the church. They had brought with them the psalm book used in the reformed churches of England, but they knew only a few tunes, and these they used over and over. Then in 1640 came the 'Bay Psalm Book', the first musical publication in America. 'A Collection of the Best Psalm Tunes', published in 1764, was engraved by Paul Revere.

A number of choral societies and singing schools were organized in the 18th and 19th centuries. The Handel and Haydn Society was formed in 1815, and the Philharmonic Society of Orchestral Players a few years later, both in Boston. The New York Philharmonic, the first professional orchestra in America, gave its first program in 1842. Today the symphony orchestra is one of the cultural assets of most large cities. (*See* Orchestra.)

Music had its first native expression in the secular song 'My Days Have Been So Wondrous Free' written in 1759 by Francis Hopkinson, a signer of the Declaration of Independence, and a close friend of George Washington. Later, the same composer dedicated a group of songs to Washington. Little can be said of the secular music of the early 19th century, except that it was overly sentimental and doleful.

Stephen Foster is America's best-known composer. 'Old Folks at Home' and 'Old Black Joe' and other songs of his are widely popular and are like folk-tunes in their simplicity and native quality. John Knowles Paine is undeservedly neglected. His 'Oedipus' and 'Nativity' were the first American compositions in large forms. Edward MacDowell wrote many charming songs, piano pieces, and compositions for chorus and for orchestra (*see* MacDowell).

The "flavor" of America is strongly felt in the music of George W. Chadwick, a thoroughly equipped composer, whose symphonies, string quartets, overtures, songs, and work in other forms are genuine contributions. Henry Gilbert was a self-educated musician who was more independent of foreign influences than were any of his predecessors or followers. Amy Marcy Cheney Beach (Mrs. H. H. A. Beach) wrote excellent music for orchestra and in smaller forms. Ernest Bloch did much distinguished work for the orchestra. Horatio Parker is best known for his oratorio 'Hora Novissima'. Frederick Converse has written more music than any other American composer—symphonies, operas, and smaller pieces—all of which reveal fine craftsmanship. John Powell has composed interesting music for piano and orchestra full of the spirit of the South. John Alden Carpenter brings humor into music in his 'Adventures in a Perambulator' suite, and his 'Sky-Scrapers' ballet is distinctly original and modern. Both Daniel Gregory Mason and Edward B. Hill have won an appreciative public particularly through their symphonies and chamber music. Charles Martin Loeffler has composed much delightful chamber music.

With the exception of Carpenter and Loeffler, all these American composers write in what is called the "conservative tradition." Now there follows a group of younger men reaching out for new ideas and new ways of expression. Chief among these are Charles T. Griffes, whose early death cut short a life of great promise; Howard Hanson, a composer of both choral and orchestral works of real distinction; Leo Sowerby, a competent and original composer; Aaron Copland, whose orchestral pieces are brilliant and forward-looking; and Roger Sessions, a composer of promise.

What Is "Jazz"?

The word "jazz" is often used to mean all popular music. Actually jazz is a distinct type of music, quite different from "swing" and "boogie-woogie." Jazz is a series of improvisations on a melody. Accompanied by a band, a succession of soloists play off-beat rhythm patterns (ragtime) around a musical theme. They change pitch and accent at will and use "blue" notes—tones between flat and natural notes. "Swing" music is played in 4/4 dance rhythm and the melody is stressed. Harmonic combinations of tones are employed, with slurred and muted instrumental effects "Boogie-woogie" is usually played on a piano. It

stresses a rolling, repetitious bass and unconventional chords. All three types have roots in the folk music of the American Negro, as he expressed festive dancing moods in "ragtime" and feelings of sadness and discontent in "blues."

The American Indian has made a unique contribution to American music. Indian tunes have vivid rhythms, usually different from those of the drums, which were the principal musical instruments. Often the singers began on a high note and ended almost in a growl. In recent years Indian melodies have been studied by several composers, and some are now known in songs that have gained widespread popularity.

Development of Hymn Writing

The singing of hymns was part of the worship of the ancient Greeks and the Jews. The Psalms are the words of Hebrew songs, which seem to have been sung responsively by two choirs. One sang the first line; the other answered with the next:

First choir: The earth is the Lord's, and the fulness thereof;
Second choir: The world, and they that dwell therein.
First choir: For he hath founded it upon the seas,
Second choir: And established it upon the floods.

And so they continued through the Psalm until the word "selah" occurred; then the singers paused and the instruments played an interlude alone, after which the singing was resumed. This style of "antiphonal" singing is still practiced occasionally. It is the forerunner of the present-day singing of hymns by church choirs and congregations. Hymns as we know them today are largely the work of writers since the 16th century. In the 18th century hymnology was enriched by the work of Isaac Watts, Philip Doddridge, Charles Wesley, and many others.

LADY PLAYING A LUTE

The lute has a tone so delicate and sweet that "soft as a lute" is a proverbial expression. Though very difficult to play, it was the favorite instrument of the Renaissance period, especially for accompanying singing. This painting is by Gerard Terborch (1617–81).

Suggestions for Study

Hebrew and Greek Music: 'Junior High School Song Book', published by E. C. Schirmer Music Company, Boston. See especially the beautiful Jewish hymn arranged for girls' and boys' voices, page 353.

Folk Songs: 'A Book of Songs', '140 Folk Songs', 'The Home and Community Song Book', published by E. C. Schirmer; 'Songs of Many Nations', published by Women's Press, New York City; 'Folk Songs, Chanteys, and Singing Games' by Farnsworth and Sharpe, published by H. W. Gray Co., New York City.

Early Vocal and Instrumental Music: 'Columbia History of Music for Ear and Eye', Period I, by Percy Scholes. Contains text and phonograph records. An example of the mixture of polyphony with chords, 'Lo, How a Rose 'ere Blooming' by Praetorius, for girls' voices only in 'A Book of Songs' (*see* above); also arranged for girls' and boys' voices in 'Junior High School Song Book'. Examples of madrigals: 'The Silver Swan' by Orlando Gibbons, and 'My Bonny Lass' by Morley, arranged for girls', boys', and mixed voices, published by E. C. Schirmer; 'Dido and Aeneas' by Henry Purcell, Oxford University Press, New York City.

Bach to Beethoven: Bach albums in 'Master Series for the Young', published by G. Schirmer, Inc., New York City; 'The Well-Tempered Clavichord'. The first work contains some of Bach's simpler music. Handel's writing may be studied most advantageously in the Sonata for Violin and Piano in A major; the celebrated 'Largo'; a short piano piece, 'The Harmonious Blacksmith'; his suites, overtures, concertos; and the famous oratorio 'The Messiah'. Volumes of Haydn's pieces for the piano are readily obtainable. The easiest way to get an idea of his music is to play one of his symphonies at the piano, four hands; for example, 'The Clock' in D major. His famous oratorio is 'The Creation'. A typical song is 'My Mother Bids Me Bind My Hair'. The Sonata for Violin and Piano in G major is suggested for study. The String Quartet in C major is a fine example of his chamber music. An album of easy pieces by Mozart is in 'Master Series for the Young'. The piano sonatas, the String Quartet in C major, and the G minor Symphony are typical of his work. These are issued for the phonograph. All the nine symphonies of Beethoven are published for the piano and are recorded for the phonograph. It would be well to begin with the Fifth, because it is the most direct. The piano sonatas are published in two volumes. There is a Beethoven volume in 'Master Series for the Young'.

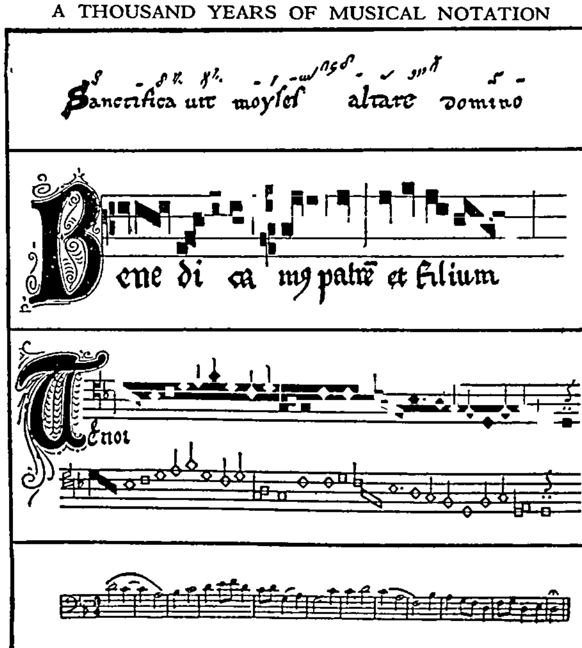
From Schubert to Tschaikovsky: Schubert's Impromptus and Moments Musicaux for piano are typical of his style. The String Quartet in A minor and the 'Unfinished Symphony' are available for the phonograph. To appreciate his music, a helpful plan is to sing some of his famous songs, such as 'Hedge Rose', 'My Sweet Repose', 'Hark! Hark! the Lark!' and 'Who Is Sylvia?' Of Schumann's compositions, the simplest are 'Kinderscenen'. More interesting are the 'Nachtstück in F Major' and the 'Romance in F Sharp Minor'. Try also 'The Two Grenadiers', 'Love-Thoughts', 'By Moonlight', 'The Lotus Flowers', and 'Thou Art Like unto a Flower' (these are the English titles for the Schirmer edition). There are phonograph records of the chamber music and many songs. Mendelssohn's easy piano pieces have been collected in album form. The nocturne from 'Midsummer Night's Dream' is beautiful and simple. Much of this work as well as his famous violin concerto has been recorded. Among Chopin's nocturnes, preludes, and études there are a few comparatively easy to play. Phonograph records have been made of his greater piano compositions. Tschaikovsky's great symphonies are all available on phonograph records. His moving song 'None But the Lonely Heart' is a favorite for both male and female voices.

From Wagner to the Present: Typical selections from Wagner's music may be made from the opera 'Die Meistersinger'. The prelude to that work is especially recommended. Many scenes from the operas are recorded. Some of César Franck's work may be studied in 'A Book of Songs'. His violin sonata, symphony, quintet, and symphonic variations are recorded. Several melodies of Brahms's for unison singing are in 'A Book of Songs'. In the 'Junior High School Song Book' there are nine part-songs. The symphonies, the String Quartet in A minor, the celebrated Quintet for Piano and Strings, as well as other of his works, are recorded. Several parts of Rimsky-Korsakov's 'Scheherazade' have been recorded for the phonograph, as well as 'The Flight of the Bumble Bee', a short descriptive orchestral piece. Antonin Dvořák's melodious symphony 'The New World', two overtures, some Slavonic dances, and some songs are recorded for the phonograph. Grieg's simple piano compositions and songs have been issued in albums. In addition to these are violin sonatas, symphonic pieces, and many songs. His 'Peer Gynt Suite' has long been a popular favorite. In the album of Debussy's piano music, 'The Girl with the Flaxen Hair' is recommended for study. 'L'Après-midi d'un Faune', and other pieces have been recorded on the phonograph.

Musical Notation and Theory

SCIENTIFIC analysis tells us that the pleasurable sounds we call music are created by physical factors. These are *pitch*, or vibration rate; time and accent, which are combined in *rhythm;* and *tone quality,* which is contributed by the overtones of the voices or instruments producing the sounds (*see* Sound).

To write and read music it is necessary to have a system of symbols—a special musical alphabet, as it were—to indicate pitch, time, and rhythm. As early as the 9th century, certain signs called "neumes" were placed above the syllables of the words to be sung, as memory aids to the singers. Musical notation, as we know it, was not invented until the 11th century, however, when Guido of Arezzo devised the *sol-fa* method of singing. A certain Latin hymn, the first six lines of which began respectively on the first six tones of the scale, suggested to Guido that if the singers remembered the pitch of the first syllable of each line, they could get any given note from that syllable. These syllables were *ut, re, mi, fa, sol, la.* Later *ut* was changed to *do,* and a seventh, *si* or *ti* was added. With a staff to show the relative position of the tones, variously shaped notes were gradually worked out to show length and value of each sound. At first all had black heads, but it soon became the practice to use outline symbols for the long notes. Two staffs were used, one for higher voices and another for lower voices with a note for a short cross line (now called middle C) in the position where one line normally would stand between the two staffs. This made the remaining notes of the octaves, written up and down, come in different places on their staffs. Fig. 4 on an earlier page illustrates this, with the G, or treble, *clef* (𝄞) used to mark the upper staff, and the F, or bass, clef (𝄢) used on the lower one; the clef names are derived from the lines about which the curl starts. Less commonly used is the C clef (𝄡). Placed on various lines or spaces, it marks middle C in music written for certain instruments (For illustration of orchestral score, *see* Orchestra.)

A THOUSAND YEARS OF MUSICAL NOTATION

The 9th-century neume notation (top) was little more than a reminder to the singer. By the 12th century (second example) actual pitch was indicated on a four-line staff. From the 15th to 17th centuries (third and fourth examples) the five-line staff was developed and notes were refined to give better indications of duration. Modern notation is shown at the bottom.

Notes above or below the staffs are placed on or between short *leger lines* prolonging the staff.

Sharps and Flats

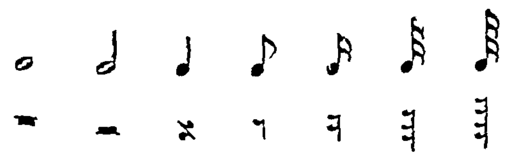
On all staffs notes have their *natural* values; that is, lines and spaces correspond to the white keys of the piano. Playing all the notes of a staff results in the scale of C major. For most other scales the natural values must be raised or lowered a half step. To show that this is to be done, *chromatic* symbols are used.

These are the *sharp* (♯), indicating the half tone *above* the written note; the *flat* (♭), marking the half tone below the one written; the double sharp (𝄪), meaning one *whole* tone above; and the double flat (♭♭), meaning one whole tone below the one written.

To avoid having to use these symbols as long as the key is played, it is customary to place the symbols just before the beginning of the music on the staff. Every note so marked is then to be raised or lowered whenever it occurs. Since certain effects require that this be *not* done, this is indicated by placing a "cancel" mark (♮) before a note to show that it has its *natural*, or unmarked, staff value.

Indicating Time, Accent, and Rhythm

We all know how the threefold rhythm of a waltz differs in "feeling" from the fourfold one of a foxtrot. The difference is in the accent, or beat. The feeling of waltz time is established by one strong beat, then two weaker ones. Foxtrot time has one strong beat, a weak one, one intermediate in strength, then a weak one. The respective patterns, are repeated as long as the rhythm lasts. The word *time* is used in music either to indicate the speed at which successive notes of the pattern are rendered (the *tempo*), or to indicate tempo and the beat pattern—as when we say "waltz time."

About a century after Guido launched the system of designating pitch by notes on a staff, Franco of Cologne, Phillippe de Vitry, and others modified it to indicate these time and beat factors as well. As finally developed, their ideas resulted in placing a line, or *bar*, across the staff before the strongest beat

The duration of notes and rests is shown by their form. The notes (above) and the rests (below) are, in order: whole, half, quarter, eighth, sixteenth, thirty-second, and sixty-fourth.

of a pattern, thus cutting the staff into horizontal *measures*, each containing a complete beat pattern; and the shapes of the notes within the measure showed how long each was to sound.

Sometimes the composer wants to have a gap, or blank spot, in his march of beats. To make the gap unmistakable, the composer marks it with a rest, of a shape signifying the duration of the gap.

To indicate the beat pattern intended, a *time signature* is given at the beginning of the music. The signature for waltz time, for example, is $\frac{3}{4}$. The 3 indicates three beats to the measure, while the 4 means that one quarter note is used for each beat. In foxtrot ($\frac{4}{4}$) time, the upper 4 indicates four beats to the measure, each one a quarter note in duration.

Ties and Slurs

Another way used to designate the duration of a note is to place a dot after it, which increases its duration by one half. Thus, a half note with a dot lasts three beats—a full measure in waltz time.

A prolonged note sometimes is indicated by writing a second note of the proper value for the prolongation and connecting the two notes by a curved line called a *tie*. This is not to be confused with a *slur*, a longer mark placed over groups of notes to indicate phrasing. In vocal music a slur indicates a breath group, and in violin music a single bow stroke.

Composers and musical editors sometimes indicate the tempo at which a piece is to be played by placing a metronome marking at the beginning. The metronome is an adjustable timekeeping device designed to beat from 40 to 208 times a minute. The marking may read, for example, "M.M.♩=96." The letters stand for Maelzel's Metronome; the rest of the marking indicates that a quarter note is to be played at a rate of 96 to the minute, as marked on the scale of a metronome. (The clockwork metronome was perfected by a mechanically minded musician named Johann Maelzel early in the 19th century.)

Melody, Harmony, and Counterpoint

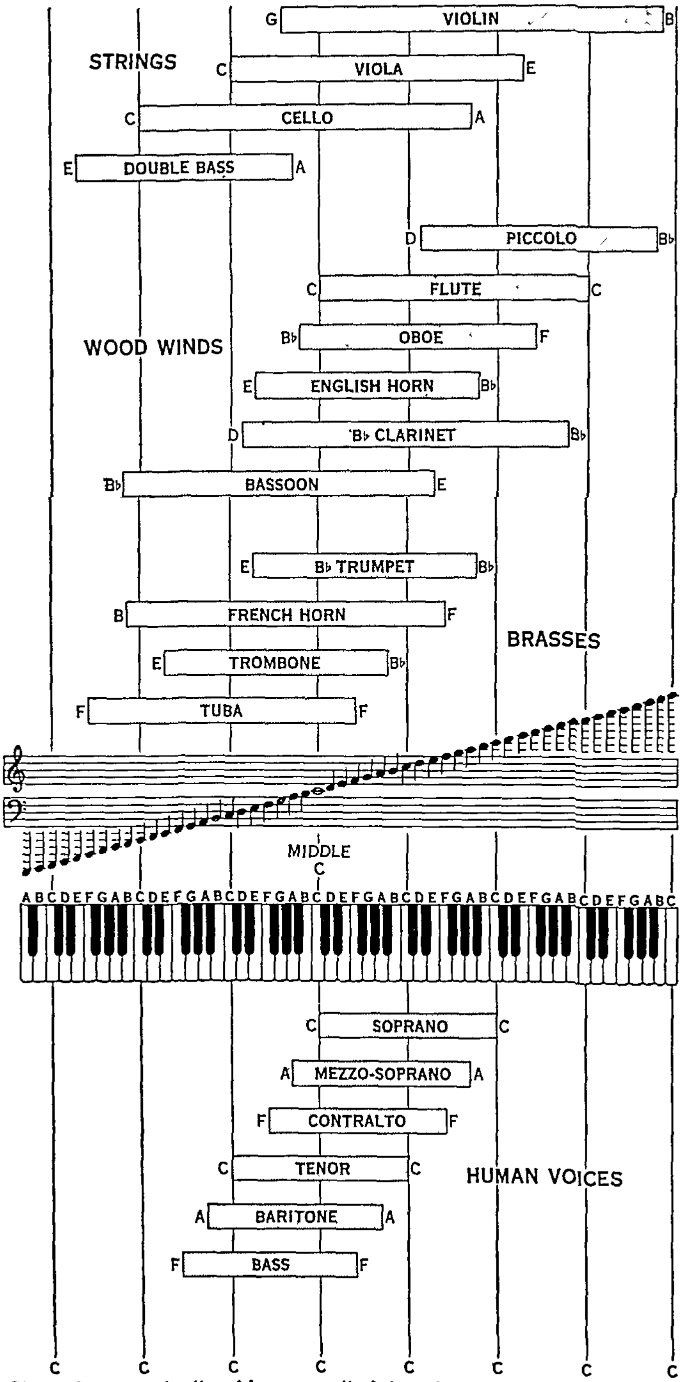
When you sound single notes of varying pitch, duration, and accent one after another, the succession constitutes a *melody*, or tune. Should you sound several different notes at once, you would have a *chord;* and the proper use of chords creates harmony. If we view music written in four-part form vertically, we see it as a succession of chords—that is, in its harmonic aspect. If we view it horizontally, tracing each melody, and its interplay against the others, we see it from the viewpoint of *counterpoint*. This, broadly speaking, is the art of weaving simultaneous melodies together into a pleasing whole.

Experience has developed certain "patterns" or set schemes for developing musical effects in an orderly, pleasing manner. In building a musical form, the composer must work with units, just as an author must put together sentences to make his story. To be pleasing, a musical unit must convey a definite sense of beginning somewhere, going somewhere, getting there, and stopping. One way of doing this is starting it and stopping it on the *tonic*, or fundamental note of the key in which it is played. It may be reinforced at these points with chords also built upon the tonic as their base. In the commonest form of close both bass and soprano sound the tonic of the chord.

Scientific Basis of Music

Music is a science as well as an art. It rests on a solid foundation of physical principles. So to understand the reasons why certain combinations of tones are more pleasing than others, we must go back to the physics of sound.

HUMAN AND ORCHESTRAL VOICES



Shown here are the "working ranges" of three important groups of instruments and of the human voice. Instruments sometimes play outside these limits, however, and all trained singers can exceed the ranges shown. The vertical lines mark the location of C at intervals of an octave. They help in locating these ranges on the piano and on the musical staff.

All sound is produced by something which vibrates. Vibrations are transmitted through the air and when they fall on the ear they are heard as sound (*see* Sound). Strike a low note on the piano with the instrument open and you can clearly see the string vibrating. Vibrations of the upper strings are hard to see but they can be felt with the fingertips. The rate of vibration is what determines the pitch of a note. For the lowest note of a piano the string makes about 27 complete swings back and forth in every second; that is, it vibrates at a rate of approximately 27 cycles a second. For the highest note of a piano the rate is greater than 4,000 a second.

If a child strikes notes at random two at a time on the piano, he soon discovers that certain combinations, or *intervals*, are more pleasing than others. Early men made the same sort of discoveries about tone, and the earliest music was based on those simple intervals. It happens that tones which sound well together always have vibration rates in simple ratios to one another. Thus a note which is an octave above another has twice the vibration rate of the first note. A note a fifth above another (as G over C) has a rate $1\frac{1}{2}$ times that of the lower. In the interval of the fourth (as F over C) the ratio is $1\frac{1}{3}$ to 1. These relationships hold regardless of the pitch of the individual notes. Any octave, for example, represents a 2-to-1 ratio, wherever it is located on the scale.

Pitch in music was once extremely indefinite, but in modern times it has been fairly well standardized. A system of pitch is defined in terms of the number of vibrations for middle A, the A above middle C on a piano keyboard. Symphony orchestras and concert artists use *concert pitch*, in which A is 440 cycles a second. This is the note broadcast continuously by the National Bureau of Standards radio station and is the A sounded by the oboe as an orchestra tunes up before a performance. The term concert pitch once indicated a system based on an A of 450 cycles a second, but this very high pitch is never used in the United States today.

Two other systems are still in use, however. In private homes, pianos are often tuned to *international pitch*, with A at 435 cycles a second, as this puts less of a strain on the instrument. Chamber music is frequently played at *philharmonic pitch*, with A pitched at 438 or 439 cycles a second.

Major Scale and Equal Temperament

Although the note A is the basis of systems of pitch, the note C is the basis upon which the keyboard of a piano or organ is arranged. Strike C on a piano and then in succession strike all the white keys up to the next C. These eight notes comprise the major scale in the key of C. Notice that at two places in the scale there is no black key between successive white keys. These intervals are between the third and fourth notes of the scale and between the seventh and eighth notes. As one plays the scale it is easy to hear that these intervals are smaller than the intervals between other successive notes. They are

called half steps. Any series of notes that consists of two whole steps upward, a half step, three whole steps, and another half step is a major scale. By using the black keys, which are half steps between white keys, a major scale can be started on any note.

The vibration ratios of the notes comprising the major scale reveal an interesting problem in tuning keyboard instruments such as the piano. The vibration ratio between G and C (the interval of the fifth) is $1\frac{1}{2}$ to 1, as we have seen. The figures for all eight notes of the scale are as follows:

C 1; D $1\frac{1}{8}$; E $1\frac{1}{4}$; F $1\frac{1}{3}$; G $1\frac{1}{2}$; A $1\frac{2}{3}$; B $1\frac{7}{8}$; C 2.

Now suppose a scale is started with the note F. The second note, G, should have a vibration rate $1\frac{1}{8}$ times that of F. This is actually the case, for $1\frac{1}{8}$ times $1\frac{1}{3}$ (the vibration rate of F) equals $1\frac{1}{2}$ (the vibration rate of G).

Suppose next that a scale is started with the note G. Now the vibration rate of A ought to be $1\frac{1}{8}$ times that of G. One and one eighth times $1\frac{1}{2}$ is $1\frac{11}{16}$, however. This fraction is slightly larger than $1\frac{2}{3}$, the value A should have as the sixth note of the C scale. The whole range of musical notes is full of similar small inequalities.

What to do about them bothered musicians for more than a century. The problem was finally solved by adopting *equal temperament*. In this system of tuning the inequalities are smoothed out, and each note is a compromise of the different values it ought to have. This system works out well in practice and the slight "out-of-tune-ness" of a piano or organ bothers no one. The great advantage of equal temperament is that a musician can play pieces in all keys on the same instrument. Johann Sebastian Bach was an early advocate of equal temperament. His 'Well-Tempered Clavichord' is a set of 48 preludes and fugues, two in each major and minor key. He wrote them partly to show the advantages of equal temperament.

Minor and Other Scales

The C-major scale is not the only one which can be played on the white keys of the piano. If we start with A and strike the white keys in succession up to the next A, we have played the *natural minor* scale. This scale gives a harsh effect at the seventh and eighth notes, however. Other scales have a half step at this point and the ear is not satisfied by a whole step. (The seventh note of a scale, when it is a half step below the tonic note, is called the *leading tone* because it leads naturally up to the tonic.) For this reason the natural minor scale is little used in modern music.

The *harmonic minor* scale overcomes the harshness of the natural minor by sharping the seventh note. This makes the note a true leading tone and the effect is more satisfying to the ear.

The *melodic minor* scale avoids the interval of a step and a half between the sixth and seventh notes of the harmonic minor scale. This wide interval (called the augmented second) is difficult for singers to handle and to some ears it sounds harsh also. Unlike other scales, the melodic minor is different going up and coming down. The ascending form is like the harmonic minor with the sixth note raised a half step; the descending form is the same as the natural minor. These are used depending on whether the melody of the piece is going upward or downward.

Still another scale occasionally used today is the *pentatonic*, or five-tone, scale. It is the same as the major scale with the fourth and seventh notes left out. Playing the black keys of the piano in succession gives the same result. The pentatonic scale is very old, perhaps the oldest scale that is still in use. Old Scottish melodies were formed from its five notes and some primitive tribes use it today. Modern composers have made use of it for special effects.

The *whole-tone* scale, often used by Claude Debussy, has seven notes. Each interval of the scale is a whole step. The whole-tone scale permits interesting harmonies, but these lack variety if overused. Actually there are only two possible whole-tone scales. One of these may be thought of as commencing on C and the other on C sharp.

The *chromatic* scale consists simply of half steps. A chromatic succession may begin and end on any note. Playing all the white and black keys in order produces the chromatic scale. It is not really a scale at all, of course. Since it has no definite beginning or ending it has no "key" feeling.

(A list of the terms most commonly used in music will be found with the entry **Music** in the FACT-INDEX.)

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MUSICAL INSTRUMENTS. No one knows how musical instruments began. Perhaps early men devised instruments to imitate sounds they found pleasant—the twang of a bowstring or the singing of the wind.

It is certain, however, that the three main classes of instruments in use today have existed since the very beginning of history. These are the string, wind, and percussion instruments.

String Instruments

Oldest of all the string instruments is the harp. The ancient Greek lyre was a primitive harp with three to ten strings. During the Middle Ages the harp took the shape which characterizes it today and more strings were added. The modern harp has a range nearly as great as the piano. It is adjusted to particular scales by the use of pedals. (*See also* Harp.)

From the harp were developed the harpsichord, clavichord, and piano. In the harpsichord the strings are plucked. In the clavichord they are struck with brass *tangents*, or hammers. In the piano they are struck with felt hammers. (*See also* Piano.)

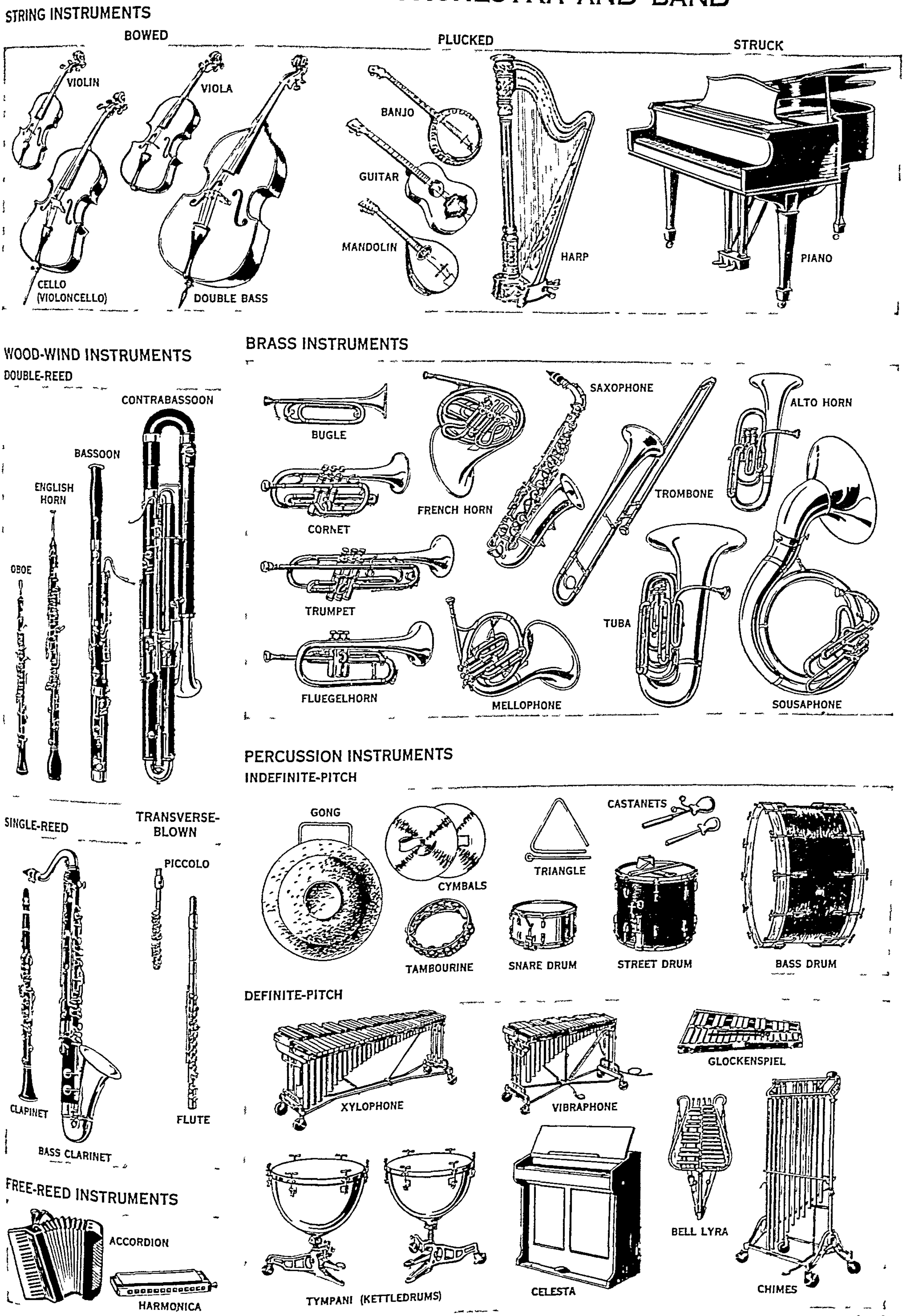
With instruments such as the guitar the player shortens (*stops*) the strings with his left hand while plucking them with his right. The banjo, mandolin, lute, and Russian balalaika are similarly played. The zither, however, is laid flat for playing. (*See also* Banjo; Guitar; Mandolin.)

The violin, an extremely important member of the string family, is played by drawing a horsehair bow across its strings. Closely related to the violin are the viola, violoncello ("cello"), and double bass. They are larger forms of the same type and produce deeper tones. (*See also* Violin.)

Wind Instruments

Orchestras and bands include many wind instruments. They belong to three groups—wood winds,

INSTRUMENTS OF ORCHESTRA AND BAND



free-reed instruments, and brasses. Though some of the wood winds are now made of metal, they were all originally made of wood, and the name was given them for that reason. Simplest of the wood winds is the recorder, a soft-toned instrument once almost extinct but now frequently played by amateurs. A recorder is shaped and played like an ordinary whistle. Nine holes permit it to be played in all keys. The flute is transverse blown; that is, the flautist blows across a hole in the side of the instrument. Modern flutes are often made of silver. The piccolo is a small flute of high range; the fife is a somewhat similar instrument used in military bands.

The other common wood winds of the orchestra are reed instruments. Their tone is produced by the vibration of a *reed*, a thin slip of wood, cane, or reed. In single-reed instruments, such as the clarinet, the reed vibrates against a stationary part of the mouthpiece. In double-reed instruments, such as the oboe, English horn, and bassoon, two reeds vibrate against each other. The bagpipe is a curious type of reed instrument (*see* Bagpipe). It uses both double and single reeds and has a leather bag to keep up the wind supply. (*See also* Wood-Wind Instruments.)

In free-reed instruments the reeds are made of thin brass. They swing freely in an air passage instead of striking, as do the reeds of oboes or clarinets. The reeds of the harmonica, or mouth organ, are typical free reeds. The reed organs used in small churches employ wind from a bellows operated by the player's feet or by an electric motor. The bellows of an accordion forces air through the reeds whether the player is opening or closing it. The piano accordion has a short keyboard on which the performer plays the melody with his right hand. Some 120 buttons controlled by the left hand supply the octaves and chords of the bass part.

In brass instruments the player's lips are pressed against a cup-shaped mouthpiece and create the vibrations that produce the tone. Sweetest-toned of all the brasses is the French horn. The tone of the trumpet is piercing, the trombone sonorous, and the tuba deep and gruff. In military bands these brasses are supplemented or replaced by such instruments as the mellophone, cornet, fluegelhorn, alto horn, and sousaphone. The bugle is used only for sounding military calls as it can produce but few notes. The saxophone is usually classed as a brass instrument but could almost equally well be called a wood wind. It has a single-reed mouthpiece, similar to that of a clarinet, and a brass body. Saxophones, constructed in a variety of sizes and pitches, are favorite dance-band instruments. (*See also* Horn, Musical.)

The pipe organ, greatest of all wind instruments, produces more kinds of tone than any other instrument. An organ has pipes of many sizes, types, and materials. Some organs also are equipped with chimes and bells. (*See also* Organ.)

Percussion Instruments

The last big class of instruments, the percussion instruments, includes all those which are struck to produce tones. (To *percuss* is to strike.) Some of these have tones of no definite pitch; others are tuned to produce real notes.

Of indefinite pitch are most drums, such as the bass drum and snare drum. The street drum used by marching bands is a type of snare drum. Such instruments as the tambourine, gong, cymbals, and triangle add brilliance to orchestral passages. The clicking of castanets is an accompaniment of many Spanish dances. The castanets used in a symphony orchestra have a handle for ease in playing.

The percussion instruments of definite pitch include many bell-like instruments upon which melodies may be played. The chimes and glockenspiel of the orchestra and the bell lyra of marching bands are struck with mallets. The celesta is a keyboard instrument whose tones are produced by metal bars. A xylophone is a set of blocks which the player strikes with mallets. Similar instruments are the marimba and marimba-xylophone; they are equipped with hollow resonators which increase the volume of the tone. The vibraphone has metal bars in place of wooden blocks, and in each resonator is a motor-driven fan which gives a tremolo effect to the tone. The tympani, or kettledrums, are indispensable in a modern symphony orchestra. Used in pairs, they are usually tuned to the tonic and dominant notes of the key in which the orchestra is playing. (*See also* Drum.)

MUSK DEER. From very early times this animal has been hunted for the musk which it yields. It differs from other members of the deer family in having no antlers in either male or female. The male, however, has sharp tusks projecting downward from the upper jaw which are used in fighting. Musk deer inhabit the high plateaus of central Asia, usually living alone, rarely in pairs, and never in herds. They are shy, feeding mainly at night, and on account of the difficulty of approaching them they are usually caught in traps. A full-grown specimen is about 3 feet long and 20 inches high at the shoulders. They vary in color, but are commonly grayish or yellowish-brown, and whitish below. The musk, found only in the male, is in a small sac on the under surface of the abdomen. Musk is of great value in making perfume and is an important article of commerce throughout Asia. Scientific name, *Moschus moschiferus*.

MUSK OX. This animal of arctic America, which looks like a small buffalo, has a dark brown coat of hair, short and curly on the neck and back, but so long on the sides that it almost sweeps the ground. The short tail and small ears of the musk ox are hidden in the long fur.

The great curved horns, whose massive bases meet across the forehead of the adults, make effective weapons against wolves who prey upon the calves. When the wolf pack charges, the bulls and cows form a circle around the calves and, with heads outward, present an impregnable barricade of sharp horns. This strategy is successful against wolves, but against Eskimos and white men hunting with firearms it means sure death to entire herds. An average bull reaches

a weight of 600 pounds. The animal gets its name from its peculiar musky odor. The cause of the smell is not known. It does not seem to come from the secretion of any particular gland, as in the musk deer and the muskrat. In herds of 20 or more, musk oxen go great distances, seeking the moss, lichens, grasses, and willow and evergreen shoots which they eat. Eskimos and Arctic explorers find them valuable food animals. The flesh of the young is good to eat, but that of old bulls is tough and musky. Scientific name, *Ovibos moschatus.* (For illustration in color, *see* Arctic Regions.)

MUSKRAT. The dome-shaped mounds of mud and cattails scattered over a marsh or pond are a muskrat "town." The streets are narrow channels cut through the plant growth. In the early morning or evening the animals can be seen swimming along the channels. They look like small beavers and have some of their habits. Like beavers, they are good builders and hard workers. However, they are more closely related to meadow mice.

Muskrats get their name from the two musk glands under the tail. These produce a musky odor. The animals live in marshes, ponds, and slow-moving streams. They are found all over North America, from as far north as trees grow in the Arctic to the Mexican border. They eat any kind of water plant, and they are fond of fresh-water clams.

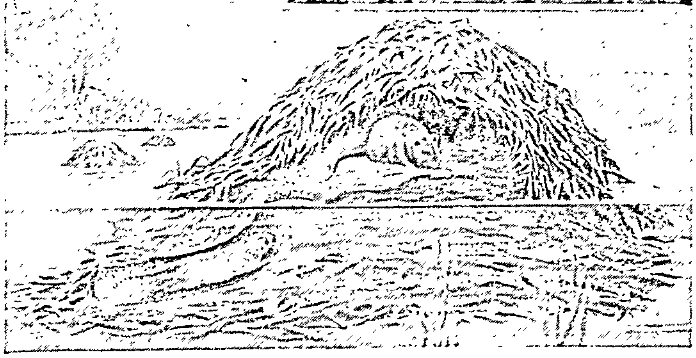
The animals are well built for living in the water. Their brownish-red fur is warm and waterproof. The fur next to the skin is fine and thick. The outer surface has coarse guard hairs. The body is about a foot and a half long and weighs about two pounds. The tail is ten inches long. It is scaly and bare and is flattened sideways. The muskrat uses it to steer and push its way through the water. The back feet are partly webbed. They make good swimming paddles and mud shoes. Males, females, and young all look alike.

Muskrats build their houses in water not more than two feet deep. They heap up a dome-shaped mound of mud, cattails, and other plants. The mound rests on the bottom of the marsh and rises two to four feet above the water. Then the little builders dig a tunnel from the base up into the mound. Just inside the top, a few inches above the water, they hollow out a room. The room may have two tunnels leading into it, and some large houses have several rooms. If the stream or marsh has a muddy bank the muskrats may hollow out a chamber in the bank instead of building a house.

The chambers are used as winter sleeping quarters and as nurseries for the young. They have thick, warm beds of dry leaves and grasses and are kept very clean. The muskrat does not eat at home. It has many tiny dining rooms scattered all over muskrat town. These are simply pushed-up mounds of weeds, just large enough for one rat. The mounds keep the animal hidden from enemies while it eats.

THE MUSKRAT AND ITS HOUSE

At the right a muskrat busily hunts for food among the plants on shore. The sketch at the bottom shows how a muskrat house would look if it were cut down the middle. It rests on the bottom of the pond, with the room hollowed out above the water level. Notice how the muskrats pass through the underground tunnel and enter the room through the floor. The house is made of mud plastered with reedy plants.



With their warm coats, muskrats do not fear cold weather. They do not hibernate, but keep active all winter, eating roots and stems of underwater plants.

Muskrats begin to mate in late winter and early spring. The males do not live with any one female or help with the care of the young, called "kits." The kits are born about a month after mating. There are four to twelve in a litter and four or five litters a year. The kits are blind and helpless at birth. In a month they are able to care for themselves, and at six months they start raising their own families.

With good luck, muskrats may live ten years. But they have many enemies—fox, mink, otter, owls, hawks, and human trappers. The fine, thick undercoat of the muskrat is one of the most popular of all furs. It is used both in the natural color and dyed. Muskrat fur dyed to look like seal is called "Hudson seal." Throughout the United States, 12 million or more muskrats are trapped each year. This is greater than the catch of any other fur-bearing animal. The coastal marshes of Louisiana and Maryland yield most of the muskrat pelts. The tender flesh is edible. The animal is also known as the musquash. Scientific name, *Ondatra zibethica.*

MUSSOLINI, BENITO (1883–1945). The spirit of conflict always drove Mussolini. It swept him through a turbulent career as teacher, laborer, editor, soldier, politician, and revolutionary. It lifted him to that day of Oct. 30, 1922, when he founded Fascism and became dictator of Italy. It cast him down 23 years later to ignominious death.

His span of conquest and tawdry defeat began in near-poverty. Mussolini was born in Dovia di Predappio, a village in the Italian Romagna. His mother was a pious schoolteacher, his father a needy blacksmith. In his teens, Benito (named for the Mexican revolutionary, Benito Juárez) became a Socialist. He took up teaching, but soon tired of it and roamed Europe. A pacifist, he fled to Switzerland in 1902 to escape military service. There he was jailed for inciting disorder, and returned to Italy in 1904.

For ten years, this short, powerfully built, heavy-jawed man worked to spread socialism, supporting himself by teaching and writing. Another term in jail failed to sway him. A gifted journalist, he also wrote a novel, 'The Cardinal's Mistress', and a biography of John Huss. His newspaper *La Lotta di Classi* (The Class Struggle) won him such recognition that in 1912 he was made editor of *Avanti* (Forward!), the official Socialist daily published in Milan.

When the first World War began, Mussolini's outlook changed. From being a reformer, he became a worshiper of power. He disagreed with the majority of the Socialists and advocated Italy's entry into the war on the Allied side. Expelled from the Socialist party, he founded his own newspaper *Il Popolo d'Italia* (The People of Italy) and called Italians to arms. In 1916 he enlisted, was promoted to sergeant, was wounded, and in 1917 returned to his newspaper.

Rise to Dictatorship

During the chaos which gripped Italy after the war, Mussolini's influence grew swiftly. While other leaders appealed to special groups, such as industrialists or farmers, Mussolini offered a program of power and action that attracted all Italians. He promised something for everyone. Into a private army of Blackshirts, he recruited Socialists, veterans, unemployed—all who dreamed of a new, dominant Italy. (His rise to power is described in the articles on Fascism and on Italy.)

As dictator, Mussolini founded Fascism. This system of government gave him the right to make all decisions. He became *Il Duce* (Italian for "the leader"). He used his power in an attempt to give Italy self-sufficiency and military leadership. He built roads, harnessed rivers, drained marshes for farms, increased production, and tried to colonize Eritrea and Libya on a grand scale. He proudly built a large army. In defiance of the League of Nations, he seized Ethiopia in 1936 and Albania in 1939. At the height of his career, he boasted that he was regaining for Italy the glory and prestige of ancient Rome.

Defeat and Degradation

But the iron government Mussolini created turned on him. Mussolini's apparent triumphs had led Adolf Hitler to organize Germany on the Fascist pattern (*see* Dictatorship; Hitler). Soon totalitarian Germany outdistanced totalitarian Italy, and Mussolini became Hitler's pawn. Meanwhile *Il Duce's* harsh rule had made him enemies at home, and his international arrogance had helped pave the way to the second World War.

In the war, his vaunted legions had to be helped by German troops, who then occupied Italy. After the Allies invaded Sicily in 1943, war-tired Italy forced Mussolini to resign and imprisoned him. Rescued by German troops, he set up a puppet rule for German-occupied northern Italy. But on April 28, 1945, after trying to escape into Switzerland from the Allied advance, he and several followers were seized near Como by Italian partisans and shot. Their bodies were taken to Milan, the birthplace of Fascism, and thrown into the streets for the crowds to jeer. (*See also* World War, Second.)

MUSTARD. Physicians knew the medicinal value of mustard over 2,000 years ago, and it was early used as a condiment. Mrs. Clements, of Durham, England, in 1720, is said to have been the first to grind the seeds into flour for table use. Commercial mustard is prepared from two varieties of the mustard plant—one having black seed, the other white. Almost all black seed comes from Montana. California, Washington, Oregon, and North Dakota also grow some. The best grades of white seed are cultivated in England and the Netherlands. Each seed weighs one-fiftieth to three-fiftieths of a grain. (For blossom in color, *see* Flowers.)

Dry mustard is prepared by cleaning the seeds, extracting their oil in presses, grinding them, and sifting the flour through silk cloth. Usually the two varieties are blended, the black for aroma, the white for pungency. Wet or prepared mustard is made by adding vinegar, salt, and spices to the crushed seeds.

Mustard is a counterirritant when used as a plaster, in liniment, or in foot baths. It is a stimulating emetic; that is, taken in warm water, it empties the stomach and stimulates heart action and respiration, making it valuable in cases of poisoning. White mustard is grown as a salad green and as forage for sheep. The plant belongs to the genus *Brassica* of the mustard family *Cruciferae* (*see* Cabbage).

MYRTLE. The common myrtle is a beautiful evergreen shrub or small tree native to the countries of the Mediterranean. Among the ancient Greeks it was sacred to Aphrodite as the symbol of youth and beauty and was much used in their festivals. It is not found in the United States except where cultivated, but the name is sometimes improperly applied to other plants. This classic myrtle (*Myrtus communis*), which grows from 6 to 20 feet high, has glossy leaves and fragrant white or rose-colored flowers, followed by pulpy black berries. Perfume is made from the aromatic leaves and berries. In some parts of southern Europe the bark is used in tanning leather.

The trailing myrtle, which is common in gardens, cemeteries, and shaded parks, is an evergreen perennial showing many varieties. It is not a true myrtle but belongs to the periwinkle genus. After its lovely blue flowers have bloomed, they are succeeded by slender many-seeded follicles. The scientific name of the trailing myrtle is *Vinca minor*. It has a creeping stem, with short flower stems. The solitary flowers grow in the axils of the leaves.

MYTHOLOGY *and Its* GROWTH *from* PRIMITIVE TIMES

Some of the colorful gods, goddesses, and mortals from Greek mythology are shown here. First is Zeus, in the shape of a bull, bearing away the maiden Europa. Next is brave Perseus, holding the snaky-haired head of the slain Medusa. To the right Pandora opens the forbidden box and lets loose a swarm of troubles. Finally Bellerophon rides his winged steed Pegasus in an attempt to climb to heaven. (The drawings in this article are by Steele Savage.)

MYTHOLOGY. To understand the meaning of mythology we have to go back to early times when primitive man lived in a universe which he could not understand.

Mythology began in man's desire to explain this universe. He created stories about the sun and the moon in order to understand why they appeared in the sky and then disappeared. He created a story about everything that puzzled him. Therefore, mythology represents man's first attempt at science, at finding out. Mythology too is man's first attempt to answer the question, "Who made the universe, and what is my relation to Him?" This question can only be answered by religion—by faith, by belief. Mythology then, is one of the steps in the long attempt of man to relate himself to God.

How Myths Began

As man's knowledge grew and changed so his ideas of God developed and changed. The idea of one God did not always exist. Before man began to believe in one God, he believed in many gods. The corn grew. Primitive man, discovering this fact, thought that it was a god, a spirit in the corn, that made the corn grow. And because he was fed by the corn, he worshiped the god within. It thundered. Primitive man thought that a god was angry and threw a hammer across the sky. The sea moved backward and forward. Since primitive man knew nothing about tides, he reasoned that it must be a god who made the sea move. So he gave that god a name and worshiped it.

For men who lived in very ancient times, everything had a life of its own—not only the forces of nature, but stones, trees, and even objects which were man-made. Man might worship a plough which he fashioned with his own hands because it helped him; or the fire, or a kettle in which he cooked. Everything was given a life, a spirit, which had to be worshiped, prayed to, so that it would continue to help him.

In the fairy tales, chairs and tables often talk, and trees, and pots, to say nothing of animals. These tales are scraps of religious belief out of the time when man thought that everything was given the same five senses that he had, and that everything had the same power to feel.

Primitive man felt keenly a relationship with animals and never doubted that they talked, felt, and reasoned, as he did. Often he made images to worship and gave them the shapes of animals because he felt that the animals were more powerful than he was and could therefore protect him from all that he feared. The Egyptians' gods had the bodies of men, but the heads of lions or cats. The Aztecs of Mexico worshiped monsters in the shape of feathered serpents. The Hopis, a tribe of American Indians, still perform a dance once a year using live snakes and then setting

them free to carry the prayers of the people to the power that makes rain.

Standards of Right and Wrong Develop

When men banded together for security into tribes and clans, they established laws for the welfare of everyone, and they built towns, cities, states, and nations. And they also brought their beliefs together and created a religion for the tribe, the clan, the nation. They gave the gods names and described the extent of their powers. One goddess controlled the harvest and was worshiped when the crops were brought in. Another god brought back the spring each year and was worshiped with ceremonies of dance and song. A god protected the home, and a sacrifice was made to him. Another god made the grapes grow and was praised in prayer and song. And from the worship of these gods came certain standards of right and wrong, so that codes of honor and behavior developed.

Myths Are Often Similar

The mythologies of the world mirror the culture and progress of those who created them. Climate, the ways in which life was sustained, the ways of nature, the history of the earth are all recorded in these mythologies. There is a fascinating and striking likeness among them all, and one often finds the same story in the mythologies of peoples in widely separated sections of the earth.

The story of the destruction of the world by a great flood and the miracle of man's survival has many versions. In Greek mythology the story runs something like this: "Zeus poured a great rain from the sky upon the earth. The rain washed down the greater part of Greece so that all men perished, except a few who fled to mountains near by. Deucalion, son of Prometheus, the firebringer, had been advised by his father to build a chest or ark and to store in it what was needed for himself and his wife. When the flood came, Deucalion floated over the sea for nine days and nine nights and landed at last on Parnassus. And when the rains ended, he came from out the ark and made sacrifice to Zeus. Zeus sent his messenger, Hermes, to Deucalion to tell him that Zeus would grant whatever he wished. Deucalion wished for men, and Zeus told him to pick up stones and throw them over his head. The stones which Deucalion threw turned into men and those thrown by his wife, Pyrrha, became women." A slightly different version of the Greek story of how the world was repeopled is told in the article on Deucalion.

The powerful Atlas dared to rebel against Zeus. As a punishment he was made to bear the weight of the world and of the heavens forever on his broad shoulders.

Here is the story of a great flood as the Algonquin Indians knew it, adapted by Frances Clarke Sayers. "There was a great flood which submerged the whole earth, and only a few people escaped. They saved themselves by jumping upon the back of a huge turtle. As they floated along a great bird, a loon, flew over them, and the men and women on the turtle's back begged the loon to dive to the bottom of the waters and bring up a piece of earth from the depths of the water. But the waters were so deep that the loon could not find the bottom. Then the loon flew far away, and when he returned he brought a piece of earth in his bill. The turtle knew that the bird had found earth once more and he followed the flight of the bird and was brought to the land. Then the men and women began a new world and repeopled it." In some similar Indian stories, a canoe takes the place of the turtle. In others, men escape on a raft.

Greek Mythology

There is one mythology which is most deeply rooted in our world today: the mythology of the Greeks. It existed as a religion five hundred years before the birth of Christ. But from it and from the life which produced it have come a great part of our language, our ideas of beauty, and some of the most beautiful and poetic stories ever dreamed or imagined. Hardly a day passes that you do not hear or see something which remains to us from that ancient, beautiful time. Look at a picture of the Lincoln Memorial in Washington, D.C. The architecture of that building is modeled after the ancient Greek temples in which the Greeks worshiped their gods. Almost every town in America has a Greek temple somewhere among its banks, churches, schools, or libraries.

Each time you use an *atlas* you put your finger on a thread that leads backward into Greek mythology. That book, with its maps of the world, is called an "atlas," and it is named after Atlas, the Greek Titan who lived even before the gods. The Greeks believed that he held up the world on his shoulders.

How often have you seen the figure of the winged god, Mercury, or Hermes, as the Greeks called him, with wings on his feet and on his hat, carrying a staff, called the caduseus, which is topped with wings and surrounded by entwined serpents? This was the god as the Greeks pictured him, swifter than thought,

the messenger of the gods. He was worshiped by merchants, and by thieves too, because he was so quick. To this day he is used as the insignia for many traffic signs and messenger services. The quicksilver in a thermometer is called mercury after this god. His name stands as a symbol of speed and movement.

This Greek mythology follows the pattern of other mythologies. The forces of nature were given personalities and were worshiped. The streams were endowed with life. Stories were invented about stones and mountains, sun, moon, and stars. But there is a grandeur in the Greek myths which no other mythology has equaled. It is heroic in its ideals and full of beauty, courage, and hope. In the history of the growth of man's mind it stands like a great mountain peak, an everlasting monument to the heights man can reach through the power of his imagination and spirit.

There is no worship of animal gods in the Greek mythology. While Pan had the horns, hoofs, and tail of a goat, his head was that of a god. The Greek gods were pictured as being very like men and women, only more heroic in stature, more perfect in beauty and proportion, more powerful and more enduring. The Greeks also gave their gods some of the human frailties. The gods were jealous, envious, and often small natured. Though they knew pity and love, they were not all-loving or all-kind. Zeus alone, the greatest of the gods, was spoken of as "The Just."

Greek Joy in Life

Primitive peoples usually fashioned their gods out of fear. That is why they were often monstrous, and the ways of worshiping them were often cruel and hideous. But the Greeks, for the first time in the history of man's thought, fashioned their gods, not out of fear, but out of a surging joy in life. All through their stories the gods delight in the sweet experiences of living. Their stories are filled with a love of nature, the joy of waking and sleeping, the blessedness of bathing in the sea. The Greeks found everlasting delight in "the wine dark sea" and the "rosy-fingered dawn." All the sweet simplicities of life they sang, as well as battle and the glory of courage and fighting. The Greeks were the first to turn from fear of life to exultation in it. Their mythology expresses man's first awareness of the beauty of life and the power within himself to control that life and make it even more beautiful.

This Greek pattern of thought remains a great mystery. It can be accounted for in part by the fact that the sky above Greece was and is a beautiful, clear sky. The Mediterranean Sea is an azure sea. Life among the mountains of Greece developed strong, independent men who led a vigorous life. The valleys were beautiful and the earth produced abundant crops. No doubt the geography of the land, the weather, the light of the sky all contributed to the mind we know as Greek. It was indeed a time in which, as Walter Pater said, "the sky was charged with marvels."

The Gods on Mount Olympus

The Greeks believed that the gods lived upon a mountain of great height and beauty—Mount Olympus. There they dwelt together in a community of light and pleasantness, and from this height they mingled with the lives of mortals.

Before the gods there had been the Titans, children of heaven and earth. Zeus, son of Kronos the Titan, overthrew his father and seized the power. Zeus, the Thunderer, was most powerful, and other gods obeyed him. He ruled the universe with eleven other Greek gods. Poseidon, his brother, ruled over the waters of the earth, and Hades, later also called Pluto, was king of the underworld and the dead. Hestia, sister of Zeus, was sacred to the hearth and home. Hera, wife of Zeus, was the goddess of marriage and was worshiped by women. Ares, son of Zeus, was the god of war.

Athena was the favorite daughter of Zeus. Because she had sprung full-grown out of the forehead of Zeus, she was the goddess of wisdom, called the "grey-eyed." Athens was the city sacred to her, and the great Greek temple, the Parthenon, was built to do honor to her name.

Apollo was the son of Zeus, and he it was who drove the chariot of the sun across the sky. He was the music maker, the god of light and song, and the poets worshiped him. Aphrodite was worshiped as the goddess of love. She was also daughter of Zeus, though in some stories she is said to have sprung from sea foam. Because this birth from the sea was said to have taken place near Cythera, she was often called "Cytherea the violet-crowned."

Hermes, the messenger of the gods, whom the Romans called Mercury, was also son of Zeus. Artemis, the moon goddess, was twin sister to Apollo, the sun. She was worshiped by hunters, for she loved the chase, and the woods were sacred to her. There was also Hephaestus, son of Hera, whom the Romans called Vulcan. He was the god of fire. He was ugly and was the only one among the immortal Greek gods who was not beautiful. But he was skilled in craftsmanship and forged the armor of the gods. He was the patron of handicrafts and the protector of blacksmiths.

These were the twelve great Olympians. There were also other gods, whom the Greeks worshiped. Demeter, the goddess of the grain, sometimes called the goddess of agriculture, was widely worshiped. So was Dionysus, the god of wine. Demeter was beloved because she fed the world by making the crops grow. Her chief festival was at the time of the harvest. Then she was worshiped in ceremonies so secret that we do not even know what they were.

The Story of Persephone

One of the most beautiful stories of all time concerns Demeter and the love she bore her daughter, Persephone. Persephone was stolen away from the earth by Hades, who loved her for her beauty. He took her down to his dark kingdom under the earth. There in the world of the dead he hid her. But Persephone cried out as she was borne away in the chariot of Hades, and Demeter heard the cry and rushed to rescue her. None knew where Persephone had gone and she could not be found anywhere. But

Apollo, the sun, traveling as he did under the earth as well as over it, he knew. He told Demeter that her daughter was held in the world of the dead.

Then such grief came into Demeter's heart that she could not move over the earth. She sat mourning in her temple, longing for her daughter. A whole year she mourned, and during that year nothing grew upon the earth. There was no flower of spring, no blade of grass for summer, no crops to be harvested in the fall. The whole earth was parched and dead, and famine walked the land.

Then Zeus sent Hermes down to the underworld and bade Hades send back his bride, Persephone, to her mother. And Hades knew he would have to obey. But, because Persephone had eaten one pomegranate seed in the land of the dead, she must always return to it for at least four months of the year. Though Demeter was sad to lose her lovely child four months of every year, yet she rejoiced at each return. Each year when her daughter came back, she walked over the bleak earth and made it flower and bloom and bear fruit once more. By means of this beautiful story did the Greeks interpret the miracle of spring.

There were also lesser gods: Pan was beloved by shepherds and small wild creatures. The Muses were keepers of the arts. The Naiads were water nymphs. Triton was trumpeter of the sea. Aeolus was king of the winds. And there were many more minor gods who peopled the bright world of the Greeks.

Rome Adopts the Greek Myths

The mythology of Rome is a borrowed mythology. When Rome conquered Greece, the Romans absorbed the Greek gods. They changed the names of most of them and combined them with gods of their own. The Romans were practical men. They were road builders, conquerors, and organizers. But they were not capable of imaging a bright world with gods of sunlit beauty. The clear, ardent fire of belief was not in them as it had been in the Greeks, and their stories of the gods reflect their light-hearted acceptance of them.

Hades carries beautiful Persephone down to his kingdom in the underworld. In later Greek myths Hades is known as Pluto, and the underworld itself is called Hades. The Romans also used these names and called the maiden Proserpina.

The Romans renamed most of their borrowed gods, calling the twelve Olympians in this manner: Jupiter (Zeus), Juno (Hera), Neptune (Poseidon), Vesta (Hestia), Mars (Ares), Minerva (Athena), Venus (Aphrodite), Mercury (Hermes), Diana (Artemis), Vulcan (Hephaestus). Two of the Olympians, Apollo and Pluto, kept their Greek names, but Pluto was never called Hades, as was common in Greece.

The Romans continued to worship vague powers called the Numina, but they did not think of them as having shape or form. Each family had its own god, or Lar, who was the spirit of an ancestor, and the Penates, who guarded the hearth and storehouse. These were worshiped in the home, never in temples. There was a spirit called Sylvanus, helper of plowmen and woodcutters. There was a Roman god Janus, one of the Numina, who was the god of good beginnings. The month of January is named for him.

Delighted with his wings, Icarus flies near the sun. But he disregards the warning of his father Daedalus that the wings were put together with wax. The wax melts in the heat of the sun, and Icarus falls into the sea.

Norse Mythology

In the Norse mythology there is no such love of beauty and proportion as in the Greek mythology. Odin, the chief of the Norse gods, was one-eyed. Tyr, the god of war, was one-armed. The Norse theme is heroic endurance rather than joy of the world. The rugged landscape, towering mountains, the long dark nights, the never-ending struggle against ice and cold, these have gone into the making of the Norse gods.

Norse mythology tells us that in the beginning there was Niflheim, home of fog and mist. To the south, there was Muspelheim, home of fire. Between these two was the bottomless abyss, Ginnungagap. Flame and mist combined and hung in the upper air, then fell drop by drop into the abyss.

There out of heat and cold, fog and fire, the giant Ymir came into being. He was fed by a cow, Audhumbla. As she fed the giant she licked the salt off the icy stones, and the head of a man began to be shaped by her tongue. On the third day the man stood upright. And he was called Bure. So was born the first of the Norse gods, for Bure was the grandfather of Odin. The giant Ymir fathered a race of frost giants who were enemies of the gods.

The Norse explanation of a great deluge concerns this giant Ymir. He grew to be so huge and so evil that Odin and his brothers could no longer live with him. They killed him, and the blood gushed from his body in such torrents that all the giants, except Bergelmer and his wife, were drowned. They took refuge on a chest, came to the shores of Jotunheim, and from them the frost giants sprang.

It was out of Ymir's body that the gods made the earth. From it they cut the deep valleys, wrought the huge mountains, made the fjords. Then they stretched the heavens above the earth. They caught from Muspelheim the flying sparks of its great fires and fastened them in the heavens as stars. Around the world they set the sea, and beyond the sea was the home of the frost giants. Out of Ymir's eyebrows they built a wall around the place where human beings were to live. This place was called Midgard. Then the gods made man from an ash tree and woman from an elm and set them to live there.

The gods chose as their home a plain named Ida. There they built a city, which they called Asgard. Here, the gods lived, each with his appointed guardianship. Odin was the all-father. Thor was the Thunderer; his hammer struck terror into the frost giants. Tyr was god of war. Balder, the beautiful, was god of light. Frey was god of the sun and rain; he was known as the god of fruitfulness. Freyja was goddess of love and beauty. Frigga was Odin's wife and Balder's mother. Hel was goddess of death. Loki was the evil one, half human and half god. And Heimdal was the keeper of the rainbow bridge over which the gods passed from Asgard to earth.

The gods of the North were gods who knew suffering. They lived knowing that in the end, in the twilight of the gods, they would go down to defeat under the frost giants. Nevertheless they lived in the belief that heroic action was the highest good. This foreknowledge of doom gives to the Norse mythology a tragic nobility which is to be found in no other mythology. It extols courage and heroic action, even without hope of success.

There is about Odin a special compassion and sadness. He gained his great wisdom at the price of one of his eyes. For Mimir, the wise, the giant who guarded the well of wisdom, would give him no drink from the well unless he gave an eye in return. And before Odin could learn all the power of the runes, which were magic inscriptions, he had to endure a mystical pain.

All the skill and knowledge that he won, he shared with both gods and man. His haunt was often Valhalla, the Hall of the Slain, where the great heroes were brought to feast with Odin after they had died in battle. The Valkyries, heroic, warlike maidens, carried the slain heroes from earth to Asgard. They served Odin, but their chief duty was to preside over battles deciding who should live and who should die. At the head of the great feast sat Odin, a raven on each shoulder, called Huginn (Thought) and Muninn (Memory). These were his messengers from the world.

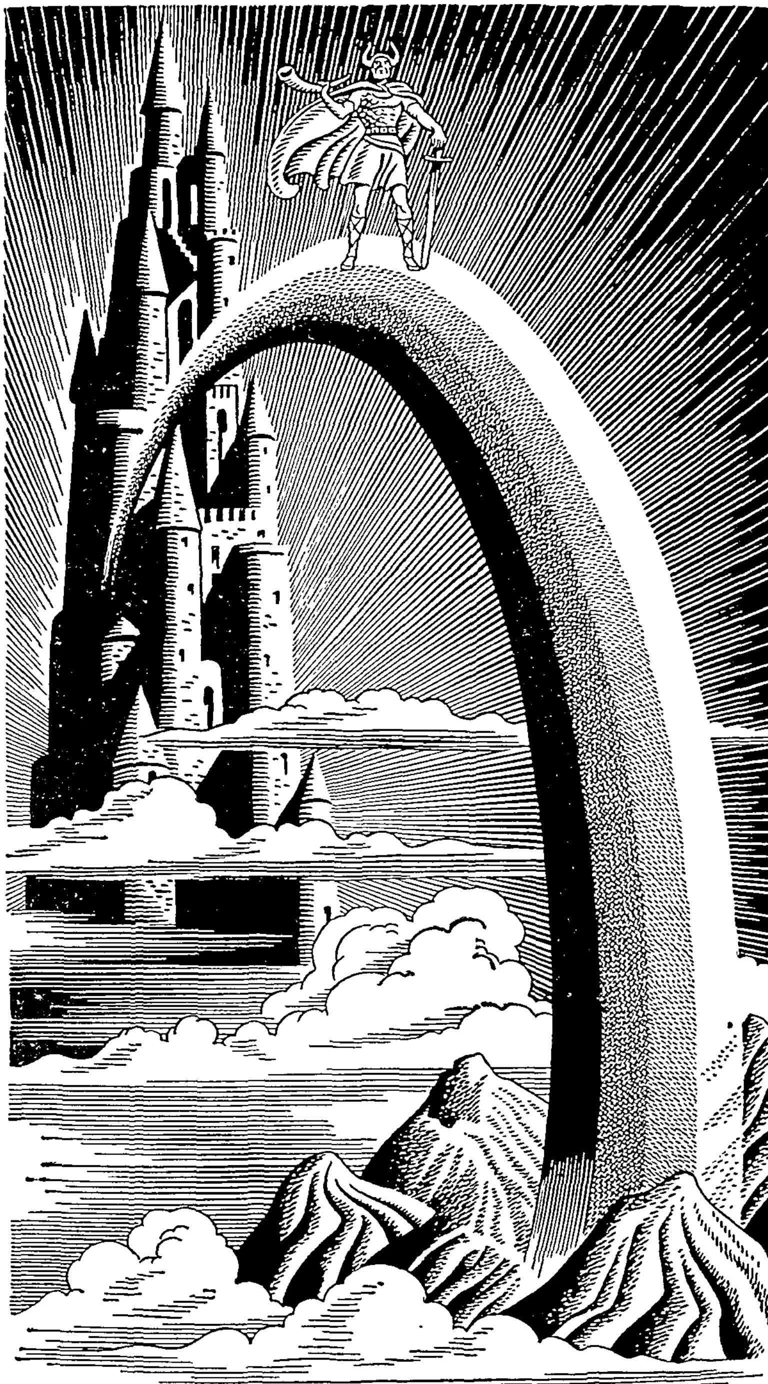
The story of the death of Balder, most beautiful and most beloved of all Norse gods, like the story of Persephone of the Greeks, is sad. But it is more tragic in its sense of doom for, because of the trickery of Loki, Balder is not permitted to return to live among the gods.

These stories too touch the life of our own Anglo-Saxon past. The days of the week take their names from those gods. Wednesday is Wotan's day, Wotan being another name for Odin. Friday is Frigga's day, Frigga being Odin's wife. And Thursday was the day sacred to Thor, the most popular of the gods.

Likeness of Myths Is Puzzling

As we compare the mythologies of peoples from all over the earth, we find many of the same stories and beliefs. They are the same, and yet different, like an eternal piece of indestructible cloth which is cut to costume the temperament, the character, and the minds of the various peoples. It is the same cloth, but the costumes are different in cut, in color, and in pattern. Each people gives its mythology its own distinct character.

How does it happen that these mythologies are similar? Scholars have puzzled over this question



Heimdal, the guard, stands on the rainbow bridge that connects the earth to Asgard, the home of the gods. Over this bridge the gods pass. And over it the Valkyrie maidens carry slain Norse heroes to Valhalla, in Asgard.

for years. Did a belief, a story, travel from man to man, from tribe to tribe, until it had gone around the world? Or has the similarity come about because, as anthropologists tell us, primitive man thinks and feels in a certain way, no matter what section of the world he lives in or at what time? There is evidence to support both theories. Perhaps there will never be a clear-cut answer which will satisfy everyone. And perhaps the truth lies somewhere in between.

As one reads mythology after mythology—one from Asia, another from Mexico—the great epic of man's unfolding mind, his soaring spirit, his triumph over cruelty and selfishness, his mounting courage and compassion are all made clear. One sees a unity in the whole immense fabric of belief. The mythologies, even those which are crude, become great sources of knowledge and of understanding.

The Literature of Mythology

How have these myths come down to us? First they were told by word of mouth, from father to son, through the long generations. At long last man discovered the skill of writing and created a written language. So for the first time the myths appeared in written form. Later, of course, they were printed in books. Naturally, writers differed in their versions of the myths, and even now we find that the same basic myth is often told in several different ways.

The first written record of the Greek mythology is found in the epic poem, the 'Iliad', attributed to the poet Homer. This is the story of the siege and defeat of the city of Troy. The 'Iliad' was followed by another glorious tale, the 'Odyssey'. (*See also* Odysseus.) Other written sources of Greek mythology are the Homeric hymns, fragmentary odes to the gods. There is also the work of Hesiod, a Greek writer, whose theme was the dynasties of the gods. Hesiod lived about seven hundred years before Christ.

There was a period of a hundred years in Athens when man reached a high peak of culture hardly equalled since that time. In this age the great Greek dramatists wrote their still famous plays, all based on the mythological themes. The names of the three great dramatists are: Aeschylus (525–456 B.C.), Sophocles (496–406 B.C.), and Euripides (480–406 B.C.). Their dramas give us knowledge of the mythology of Greece and an account of its heroes.

Ovid was a Roman storyteller. In his 'Metamorphoses' he told the stories of the Greek gods for the education of his countrymen. But he had his tongue in his cheek as he told them and often made fun of the gods he pretended to revere. It was the beginning of the end of Greek mythology *as a belief* when the Romans adapted Greek gods to their own civilization.

Rome had its epic, the 'Aeneid', written by Vergil. It tells of Aeneas, hero of Troy, who fled the ruins of Troy to found Rome and to rule Latins and Trojans together.

The brave hero Sigurd rides through a wall of magic fire to rescue Brynhild. She had been put to sleep there as a punishment for disobeying Odin. Richard Wagner uses a Germanic version of this story in his opera 'Die Walküre'.

The Norse mythology has two written sources. The first, called the Elder, or Poetic, Edda, is a manuscript of an uncertain date. It consists of fragmentary poems about the gods and about two heroic families, the Volsungs and the Nibelungs. Its origins go back to the pre-Christian culture of Iceland. Later Snorri Sturluson (1178–1241) wrote his own collection of chronicles, tales, and beliefs. His work is called the Younger, or Prose, Edda.

From these sources and from the whole Norse Mythology come some of the great epics of the world.

The story of the Nibelungs spread to Germany and is the basis of an early Germanic mythology. This great cycle of stories gave Richard Wagner inspiration for his four opera-dramas, the 'Ring of the Nibelungs'. A fragment of the Icelandic mythology found its way to early Britain and took form in the early epic *Beowulf.* Saxo Grammaticus of Denmark recorded his history of the Danish kings, mingling mythology with historical fact.

In addition to the mythologies we have discussed, there are others rich in heroic tales. Among them are the mythologies of the Celts, of Egypt, and of India. There is an ardor in all mythology, a fire that burns more intensely in the early history of a race than at any other time. To read these legends and tales of heroism when one is young is a wonderful experience.

Mythology in Art

In the world's great art galleries are many famous paintings of mythological characters. A few of the best known are 'The Birth of Venus', painted by Botticelli, 'The Nymph Galatea' by Raphael, and 'Venus and Adonis' by Titian. (*See* Painting.) But it is the sculptors especially who have used many mythological subjects. It is not surprising that they chose themes from Greek mythology, for the Greek gods and goddesses were described as perfect in beauty and heroic in stature. This preference for the Greek was true even of Bertel Thorvaldsen, the greatest Danish sculptor (*see* Thorvaldsen).

Among the many magnificent masterpieces inspired by Greek myths are 'Hermes with the Infant Dionysus' by Praxiteles and 'Perseus' by Cellini. Then there are those two famous works of art by unknown sculptors—the 'Venus de Milo' and the 'Apollo Belvedere'.

In modern sculpture too there are many beautiful figures from the world of the Greeks. Carl Milles created 'Europa and the Bull' and the 'Fountain of Diana'. 'The Flight of Europa' and 'Venus Anadyomene' are by Paul Manship. One of Augustus Saint-Gaudens' most famous works is his statue 'Diana'. (*See also* Sculpture.)

REFERENCE-OUTLINE FOR STUDY OF MYTHOLOGY

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GUIDE TO ALL VOLUMES FOR SUBJECTS BEGINNING WITH

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EDITOR'S NOTE

EVERY user of Compton's Pictured Encyclopedia should form the habit of *first* turning to the Fact-Index section at the end of each volume when in search of specific information. This index is a miniature work of reference in itself and will often give you directly the facts, dates, or definitions you seek. Even when you want full treatment of a subject, you will usually save time by finding in the index the exact page numbers for the desired material.

All page numbers are preceded by a letter of the alphabet, as A-23. The letter indicates the volume. If two or three page numbers are given for the topic you are seeking, the first indicates the more general and important treatment; the second and third point to additional information on other pages. Where necessary, subheadings follow the entry and tell you by guide words or phrases where the various aspects of the subject are treated.

The arrangement of subheadings is alphabetical, except in major historical entries. In these the chronological order is followed.

The pictures illustrating a specific subject are indicated by the word *picture* or *color picture* followed by a volume indicator and a page number. A picture reference is frequently intended to call attention to details in the text under the illustration as well as to the illustration itself. This picture-text, therefore, should always be carefully read. The pictures are usually on the same page as the text to which you are also referred; sometimes they are found in a different but related article which will add interest and information.

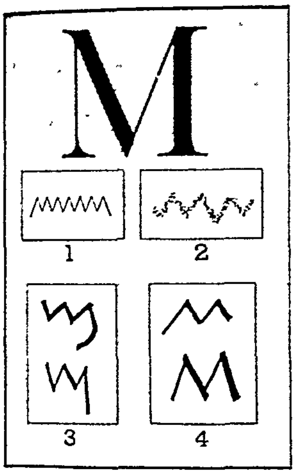
The pronunciations given are those preferred by the best and most recent authorities; alternative pronunciations are indicated where usage is divided.

In recent years hundreds of foreign geographical names have been changed, either officially or by custom. Both old and new names are given at the appropriate places in the alphabet.

Populations are those of the latest census or an official estimate when available if no census has been taken since World War II. Distances between points are map or air distances, not distances by railroad.

THE EASY REFERENCE FACT-INDEX

Reg. U. S. Pat. Off.



Our letter M probably started in Egyptian writing as a wavy or wriggly line which meant 'water' (1). Soon after 2000 B.C., a Semitic people called the Seirites adopted this line as an alphabetic sign for 'm', because their word *maim* for 'water' began with this sound.

The Seirites made the sign about as the Egyptians did (2). The later Canaanite-Phoenician alphabet gave it a tail (3). In Hebrew the sign was called *mem,* and it had similar names in other Semitic languages.

When the Greeks learned to write from the Phoenicians, they gave the letter a symmetrical, balanced shape without a tail (4), and named it *mu.* The Romans took this sign without change into Latin; and from Latin it came into English.

Our small handwritten 'm' is simply a quickly made capital, with curves instead of angles. The printed small 'm' imitates the handwritten one.

Note.—For the story of how alphabetic writing began and developed, *see* the articles Alphabet; Writing.

Maartens (*mär'tŭnz*), **Maarten**, pen name of J. M. W. Schwartz (1858–1915), novelist of Dutch birth; wrote in English, novels picturing Dutch life ('The Sin of Joost Avelingh'; 'God's Fool'; 'The Greater Glory').

Maas River, w. Europe. *See in Index* Meuse River

Maastricht (*mäs-trĭkt'*), or **Maestricht**, city on Meuse River in extreme s. of Netherlands on Belgian frontier; pop. 74,449; great sandstone quarries, worked since Roman times; beer, brandy, cigars, glass, earthenware: *maps* B-111, E-424–5

Mab (*măb*), Queen Mab, in Celtic and English folklore, a fairy presiding over dreams; in Shakespeare's 'Romeo and Juliet', Act I, scene 4; gives title to Shelley's 'Queen Mab'; originally a legendary queen, Maev of Connaught.

Mabie (*mā'bĭ*), **Hamilton Wright** (1846–1916), editor, critic, and essayist, born Cold Spring, N. Y. ('My Study Fire'; 'Essays in Literary Interpretation'; 'Essays on Books and Culture').

Mabinogion (*măb-ĭ-nō'gĭ-ŏn*), a collection of ancient Welsh bardic tales, particularly the collection of 12th-century knightly romances translated by Lady Charlotte Guest; retold in several versions for young readers: S-413

Mabuse (*mȧ-büz'*), **Jan**, name adopted by the Flemish painter Jenni Gosart (died 1532), first of the "Italianized" Flemings.

Mac, in Scottish names N-2*b*

MacAdam (*măk-ăd'ȧm*), or **McAdam, John Loudon** (1756–1836), Scottish engineer, inventor of macadam roads R-158*b*, I-132

Macadamia, a tree, *Macadamia ternifolia,* of the protea family; native to Australia but cultivated in Hawaiian Islands, s. California, and s. Florida; first planted in Hawaiian Islands in 1892; average height 30 to 40 ft., trunk about 1 ft. in diameter; leaves dark green; flowers vary in color from white to pink or red. Macadamia nut (also called Queensland nut) has hard shell and is about 1 inch in diameter. Kernel, solid and white, is edible and yields oil used in soap and in medicine.

Macadamized road R-158*b*

McAdoo (*măk'ạ-dọ*), **William Gibbs** (1863–1941), public official, born near Marietta, Ga.; practiced law 1885–1903; secretary of treasury 1913–18; married President Wilson's daughter Eleanor 1914; director general of railroads 1917–19; U. S. senator from California 1933–39.
express companies and E-458*d*

McAfee, Cleland Boyd (1866–1944), clergyman and author, born Ashley, Mo.; professor McCormick Theological Seminary, Chicago, Ill.; moderator of general assembly of Presbyterian churches of U. S. 1929–30; later secretary Presbyterian Board Foreign Missions.

McAfee, Mildred H. (Mrs. Douglas Horton) (born 1900), educator, born Parkville, Mo.; president Wellesley College 1936–49; head of WAVES (Women's Naval Reserve) 1942–46.

McAl'ester, Okla., a railroad and shipping city 66 mi. s.w. of Muskogee; pop. 17,878; center of coal fields and rich farm region: *maps* O-371, U-253

Macalester College, at St. Paul, Minn.; Presbyterian; founded 1885; arts and sciences, education, music religion.

McAllen, Tex., city in extreme s., 52 mi. n.w. of Brownsville; pop. 20,067; canning and oil industries: *maps* T-91, U-252

McAl'lister, Ward (1827–95), American society leader, remembered as originator of the phrase "the 400" for "smart" New York society; phrase said to have originated because if list were larger, the Astor ballroom could not accommodate the "eligible" guests.

MacAlpine, Kenneth. *See in Index* Kenneth I. MacAlpine

Macao, or **Macau** (*mạ-kou'*), China, Portuguese settlement and seaport on Macao Island at mouth of Canton River 40 mi. w. of Hong Kong; settlement forms with neighboring islets the Portuguese overseas province, Macao; total area, 6 sq. mi.; pop. 187,772; here Camoens finished the 'Lusiad': C-279, *maps* C-260, A-407

Macaque (*mạ-käk'*), monkeys M-352, *pictures* M-351, 352

Macaroni (*măk-ȧ-rō'nĭ*), a dandy Y-334

Macaroni, a food M-1

MacArthur, Arthur (1845–1912), general, born Chicopee Falls, Mass.; father of Douglas MacArthur; service in Civil and Spanish-American wars; military governor of Philippines 1900–1901.

MacArthur, Douglas (born 1880), U.S. Army officer M-1–2, *pictures* M-2, R-213, T-200
addresses Japanese during surrender ceremonies, *picture* W-272
in Japan J-322, 323
relieved of Far East commands T-200*b*

McArthur, Peter (1866–1924), Canadian author, born Middlesex County, Ontario; for about 18 years a journalist in New York ('In Pastures Green'; 'Around Home').

Macassar, Indonesia. *See in Index* Makassar

Macassar Strait, Indonesia. *See in Index* Makassar Strait

Macaulay, Rose (born 1889?), English author of novels, verse, essays; works have humorous, satirical touch ('Potterism'; 'Told by an Idiot'; 'Orphan Island'; 'Crewe Train'; 'Personal Pleasures'; 'John Milton'; 'The World My Wilderness').

Macaulay, Thomas Babington, Baron (1800–1859), English essayist and historian M-2–3, E-382
essays E-398
great talker C-458
quoted: on Addison, *picture* A-18; on Shakespeare S-127
story of Horatius at the Bridge M-3–4, *color picture* M-3

Macaulay, Zachary (1768–1838), father of Thomas Babington Macaulay M-2

McAuley, Catherine (1787–1841), Irish philanthropist, founder of the Roman Catholic order of Sisters of Mercy.

Macaw', South American parrots M-4, P-93, *color picture* P-92

Maçayó, Brazil. *See in Index* Maceió

Macbeth' (died 1057), usurping king of Scotland, hero of Shakespeare's tragedy 'Macbeth' M-4
chronology and rank of tragedy S-129

MacBride, Sean (*shôn*) (born 1904), Irish diplomat and lawyer, born Paris, France; began career as journalist; admitted to bar 1937, won fame as trial lawyer; founder (1946) and leader of Republican party; member Dail Eireann after 1947; foreign minister 1948-51.

McBurney, Charles (1845–1913), American surgeon, discoverer of "McBurney's point" (spot on abdo-

men where pressure reveals appendicitis) and pioneer in aseptic technique.

Maccabees (*măk'a-bēz*), distinguished Jewish family dominant in Jerusalem in 2d century B.C., descendants of the brave priest Mattathias; chief member **Judas** (died 160 B.C.); story told in apocryphal Books of Maccabees
led revolt against Syria J-353

Maccabees, fraternal society, organized 1878, London, Ontario, Canada; reorganized 1883; in 1926 Ladies of the Maccabees was merged with men's organization; local lodges called Tents (men), Hives (women), and Courts (juniors); has homes for aged at Alma, Mich., and Chatham, Pa.

McCartan, Edward (1879–1947), sculptor, born Albany, N. Y.; noted for well-designed figures and figure groups, 'Eugene Field Memorial' at Chicago, and 'Diana' in Metropolitan Museum, New York City.

McCarthy, Charles (1873–1921), political scientist and librarian, born Brockton, Mass.; organized and directed Legislative Reference Library at Madison, Wis.; author of 'Wisconsin Idea'.

McCarthy, Charlie. *See in Index* Bergen, Edgar

McCarthy, Denis Aloysius (1870–1931), American poet and journalist, born Ireland, came to U. S. when 15; poetry musical and much of it patriotic; wrote 'The Sowers' for Boston celebration of 150th anniversary of American Revolution ('Songs of Sunrise'; 'The Harp of Life').

McCarthy, Joseph R(aymond) (born 1909), political leader, born Grand Chute, Outagamie County, Wis.; circuit judge Wisconsin 10th district 1939–42, 1945–46; in World War II 1942–45; U. S. senator (Republican) from Wisconsin since 1947; chairman Committee on Government Operations 1953–54: E-287*d*

McCarthy, Justin (1830–1912), Irish historian, author, and nationalist leader of the more temperate kind; in parliament 1879–1900; but his chief interest was in literature ('Miss Misanthrope', novel; 'History of Our Own Times', story of reign of Queen Victoria; 'History of the Four Georges'). His son, **Justin Huntly McCarthy** (1860–1936), is also known as a novelist and historian, but still better as poet and dramatist ('If I Were King', novel adapted for stage).

McCarver, Morton Matthew, pioneer in western U.S.; staked out tracts of land and sold them; went to Washington from Oregon 1868: T-2

McClel'lan, George Brinton (1826–85), American general M-4–5, C-334, 335, 337, *picture* L-249
Antietam A-264

McClintic, Guthrie (born 1893), theatrical producer and director, born Seattle, Wash.; directed many plays for his wife, Katharine Cornell, including 'The Green Hat', 'The Barretts of Wimpole Street', 'St. Joan', 'Anthony and Cleopatra'.

McClin'tock, Sir Francis Leopold (1819–1907), British admiral and Arctic explorer who led 4 expeditions in search of Sir John Franklin's expedition.

McClos'key, John, Cardinal (1810–85), Roman Catholic prelate, born Brooklyn, N. Y.; became bishop of Albany, N. Y. 1847, archbishop of New York 1864, and first American cardinal 1875.

McCloskey, Robert (born 1914), artist, author and illustrator of children's books, born Hamilton, Ohio; received Caldecott medal 1942 for 'Make Way for Ducklings'; other books: 'Lentil'; 'Homer Price'; 'One Morning in Maine'.

McCloy, John J(ay) (born 1895), administrator, born Philadelphia, Pa.; assistant secretary of war 1941–45; president, International Bank for Reconstruction and Development 1947–49; U. S. high commissioner for West Germany 1949–52.

McClure, Sir Robert John LeMesurier (1807–73), Irish admiral and Arctic explorer; traversed Northwest Passage 1850–53: P-350
route, *maps* A-189, P-346

McClure, Samuel Sidney (1857–1949), American editor and publisher, born Ireland; established the McClure Syndicate 1884, first newspaper syndicate in U. S.; founded *McClure's Magazine* 1893; "discoverer" of many of the members of its brilliant staff of writers; traveled in foreign countries making studies of national conditions ('My Autobiography').

McClurg, James (1747–1825), physician and statesman, born Hampton, Va.; member Constitutional Convention.

McCollum, Elmer Verner (born 1879), biochemist; born Fort Scott, Kan.; authority on relation of diet to growth and disease; identified vitamin A and other vitamins; professor University of Wisconsin and Johns Hopkins University
work with vitamins V-497, 498

McComb, Miss., city in farming and dairying section 62 mi. s.e. of Natchez; pop. 10,401; rayon and cotton products; railroad shops: *map* M-303

McConnell, Francis J. (1871-1953), Methodist bishop, born Trinway, Ohio; president De Pauw University, 1909–12; served as bishop number of years in Mexico and Pittsburgh dioceses; elected President Federal Council of Churches, 1928 ('Personal Christianity', 'Living Together').

McCormack, John (1884–1945), American tenor, born Athlone, Ireland; London debut 1907 in 'Cavalleria Rusticana'; New York debut 1909 in 'Traviata'; many successful roles in opera; most famous as a concert singer.

McCormick, Cyrus Hall (1809–84), inventor of harvesting machinery M-5
reaper M-5, A-59, *pictures* M-5, I-200: patented, *table* I-199

McCormick, (Joseph) Medill (1877–1925), newspaper publisher and Progressive leader, born Chicago; publisher *Chicago Tribune*, which his grandfather, Joseph Medill, had made famous; U.S. senator 1919–25.

McCormick, Robert Rutherford (1880–1955), publisher, born Chicago; brother of Joseph Medill McCormick; after 1925 sole editor of *Chicago Tribune*.

McCosh, James (1811–94), Scottish-American philosopher and educator, born Ayrshire, Scotland; had won distinction as a preacher and as professor of logic and metaphysics, Queens University, Belfast, before he was called to America 1868 as president Princeton College ('Method of Divine Government, Physical and Moral').

McCracken, Harold (born 1894), explorer and author, born Colorado Springs, Colo.; known for books on wild life in Alaska and the Arctic ('The Biggest Bear on Earth'; 'Sentinel of the Snow Peaks'; 'Frederic Remington, Artist of the Old West').

MacCracken, Henry Noble (born 1880), educator, born Toledo, Ohio; president Vassar College since 1915; authority on Shakespeare and Chaucer; author of texts on English composition.

McCrae (*ma-krā'*), **John** (1872–1918), Canadian physician, soldier, poet; served in Boer War and World War I; author of 'In Flanders Fields': P-370

McCullers, Carson (born 1917), writer, born Columbus, Ga.; novels set in the South ('The Heart Is a Lonely Hunter'; 'Reflections in a Golden Eye'; 'The Member of the Wedding').

McCul'loch, Hugh (1808–95), financier, born Kennebunk, Me.; comptroller of the currency 1863–65 and secretary of the treasury 1865–69 and 1884–85.

McCulloch vs. Maryland, case in U. S. constitutional law M-103, U-349

MacCullough (*ma-kŭl'ō*), **John Edward** (1837–85), American tragedian, born Ireland; acted with Booth and Forrest.

McCutch'eon, George Barr (1866–1928), novelist, born near Lafayette, Ind.; brother of John T. ('Graustark'; 'Brewster's Millions').

McCutcheon, John Tinney (1870–1949), cartoonist and war correspondent, born near Lafayette, Ind.; president Chicago Zoological Society 1922–49; on staff *Chicago Tribune* from 1903; won Pulitzer prize for cartoons 1931.

Macdonald, Flora (1722–90), Scottish Jacobite heroine P-410

Macdonald, George (1824–1905), Scottish novelist and poet; studied for ministry and preached for a time; wrote chiefly of Scotland and Scottish people ('David Elginbrod' and 'Robert Falconer', novels; 'At the Back of the North Wind' and 'The Princess and the Goblin', children's stories).

MacDonald, Golden. *See in Index* Brown, Margaret Wise

McDonald, Harl (1899–1955), composer and educator, born near Boulder, Colo.; on music faculty University of Pennsylvania 1926–39, director of music department 1935–39; manager Philadelphia Orchestra 1939–55; composed symphonies, tone poems, concertos, and choral works.

Macdonald, James Alexander (1862–1923), Canadian Presbyterian clergyman and editor; pastor Knox Church, St. Thomas, Ontario, 1891–96; in 1896 founded *Westminster*, a religious journal; editor *Toronto Globe* 1902–16 ('Democracy and the Nations').

MacDonald, James Ramsay (1866–1937), English statesman, first Labor prime minister of England E-370–1
Fabian Society S-217

MacDonald, Jeanette (born 1907), actress and singer, born Philadelphia, Pa.; popular in musical films ('Naughty Marietta'; 'San Francisco'; 'The Firefly'; 'Broadway Serenade').

Macdonald, Sir John Alexander (1815–91), Canadian statesman, first premier of Dominion M-6, C-99–101

Macdonald, John Sandfield (1812–72), Canadian statesman; premier of Canada 1862–64; first premier of Ontario 1867–71; independent of party lines.

MacDonald, Malcolm (born 1901), statesman, born Lossiemouth, Scot-

land; son of Ramsay MacDonald; Dominion secretary 1935–39; minister of health 1940–41; high commissioner in Canada 1941–46; governor general of Malaya and British Borneo 1946–48; made chancellor of University of Malaya 1949.

Macdonald, Marcia. *See in Index* Hill, Grace Livingston

MacDonald, Wilson (born 1880), Canadian poet; wrote melodious lyrics and nature poems ('A Song of the Prairie Land'; 'Miracle Songs of Jesus'; 'Out of the Wilderness').

Macdonald College, at Ste. Anne de Bellevue, Quebec, Canada; founded 1907; agriculture, household science, teachers' training; an incorporated college of McGill University.

McDonald Observatory, on Mount Locke, near Ft. Davis, Tex.; completed 1939; joint enterprise of universities of Chicago and Texas and affiliated with Yerkes Observatory: O-324

McDonald of Garth, John (1774?–1860), Canadian fur trader, born Scotland; joined North West Company 1791; served in western Canada and in 1813 received surrender of Fort Astoria.

Macdonell, Alexander (1760–1840), Canadian Roman Catholic prelate, born Glengarry, Scotland; emigrated to Canada with his kinsmen and formed a colony called Glengarry; made first bishop of Kingston, Ontario, 1826.

Macdon'ough, Thomas (1786–1825), American commodore in War of 1812; often called the "hero of Lake Champlain": W-14

McDougall, John Lorn (1838–1909), Canadian statesman, born Renfrew, Upper Canada; member Canadian House of Commons 1869–72, 1874–78; auditor general 1878–1905.

McDougall, William (1822–1905), Canadian statesman and one of the Fathers of Confederation, born York, Upper Canada; leader of the reform party: C-99

McDougall, William (1871–1938), Anglo-American psychologist, born England; professor psychology, Harvard University 1920–27, at Duke University after 1927; held that life is not merely response to stimuli but is purposeful striving ('An Introduction to Social Psychology'; 'Body and Mind'; 'Energies of Men').

MacDow'ell, Edward A. (1861–1908), American composer M-6, M-466

McDowell, Ephraim (1771–1830), surgeon, born Rockbridge County, Va.; practiced Danville, Ky.; performed first ovariotomy recorded in U.S. in 1809. *See also in Index* Statuary Hall (Kentucky), *table*

McDowell, Franklin Davey (born 1898), Canadian writer, born Bowmanville, near Toronto, Ontario: C-105

McDowell, Irvin (1818–85), Civil War general, born Columbus, Ohio C-333, 334
defeat at Bull Run B-350

MacDowell, Marian Nevins (Mrs. Edward A. MacDowell) (born 1857), pianist, born New York City
MacDowell Colony M-6

McDowell, Mary E. (1854–1936), social worker, born Cincinnati, Ohio; director and head University of Chicago Settlement, in stockyards district after 1893; executive Chicago branch National Association for Advancement of Colored People; director Chicago Immigrants' Protective League.

MacDowell, Patrick (1799–1870), British sculptor; distinguished for his statues of William Pitt, the earl of Chatham; a leading representative of the classic school.

McDowell, William Fraser (1858–1937), Methodist bishop, born Millersburg, Ohio; held pastorates in Ohio; chancellor of University of Denver 1890–99; elected bishop 1904 ('A Man's Religion').

MacDowell Colony, at Peterborough, N. H. M-6

Mace, originally a weapon of offense; later a staff carried into battle by medieval bishops; now a symbol of ecclesiastical or civil authority, as in English House of Commons.

Mace, a spice N-316

Macedonia (*măs-ē-dō'nĭ-ạ*), a region of s.e. Europe, once seat of empire under Alexander the Great M-6–8, *maps* M-7, G-197, 189, B-23, *picture* M-8
Balkan Wars B-26
phalanx, use of W-8
rise of empire A-147–9, G-201
Roman conquest G-201
Salonika S-29, *picture* M-8

Maceió, or **Maçayó** (*mä-sä-yo'*), Brazil, important port and capital of state of Alagôas on Atlantic coast; about 125 mi. s. w. of Recife; pop. 102,301: *maps* B-288, S-252

McElroy, Mary Arthur (1842–1917), sister of President Arthur and his White House hostess; revived pre-Civil War traditions of hospitality: W-128*a*

Maceo, Antonio (1848–96), Cuban patriot, born Santiago de Cuba; one of leaders of the first Cuban insurrection in 1866; killed in battle of Punta Brava: L-112

MacEw'en, Walter (1860–1943), landscape, mural, figure, and portrait painter, born Chicago, Ill.

McFee, William (born 1881), Anglo-American novelist, writer of sea stories, born on his father's square-rigger; went to sea (1905) as engineer and did much of his writing at sea; came to U. S. 1911; in Mediterranean with British Navy during most of World War I ('Casuals of the Sea'; 'Life of Sir Martin Frobisher'; 'North of Suez'; 'The Harbourmaster'; 'The Beachcomber'; 'Derelicts').

MacGahan, Januarius Aloysius (1844–78), journalist, born New Lexington, Ohio; reported Franco-Prussian and Russo-Turkish wars, Paris Commune; assignments in Cuba and Arctic ('Campaigning on the Oxus'; 'Turkish Atrocities in Bulgaria'; 'Under the Northern Lights').

McGee, Fibber and Molly. *See in Index* Jordan, James Edward

McGee, Thomas D'Arcy (1825–68), Irish-Canadian poet, historian, and journalist C-99

McGill, James (1744–1813), Canadian merchant and philanthropist, born Glasgow, Scotland; settled in Montreal 1774 and became a partner of the North West Company; founded McGill University.

McGillicuddy, Cornelius. *See in Index* Mack, Connie

Macgillicuddy's Reeks, mountain range in Ireland I-226

McGillivray, Alexander (1759?–93), half-breed Creek Indian chief; father, a Scottish trader in Georgia; was a British Indian agent during Revolution; tried to form Indian confederation; repudiated treaty he signed for Creeks with U. S.

McGillivray, Simon (flourished 1800–1827), Canadian fur trader; joined North West Company 1810; in 1821 signed agreement by which North West and Hudson's Bay companies were amalgamated.

McGill University, at Montreal, Quebec, Canada; chartered 1821, opened 1829; arts and sciences, agriculture, architecture, commerce, dentistry, divinity, engineering, law, medicine, music; graduate courses; several affiliated colleges
influence on modern football F-231

McGinley, Phyllis (born 1905), author, born Ontario, Ore.; light verses and essays for adults; books for children: 'The Plain Princess'; 'All Around the Town'; 'The Horse Who Had His Picture in the Paper'.

McGranery, James Patrick (born 1895), jurist, born Philadelphia, Pa.; U.S. representative from Pa. 1937–43; judge U.S. district court of e. Pa. 1946–52; U.S. attorney general 1952–53.

McGrath, J(ames) Howard (born 1903), lawyer, businessman, born Woonsocket, R. I.; governor of R. I. 1940–45; U. S. senator 1946–49; U.S. attorney general 1949–52.

McGraw, John J. (1873–1934), baseball manager, born Truxton, N.Y. B-64. *See also in Index* Baseball Hall of Fame, *table*

McGregor, James Drummond (1838–1918), Canadian statesman, born New Glasgow, Nova Scotia; member of Senate of Canada 1903–10; lieutenant governor of Nova Scotia 1910–15.

MacGregor, John (1825–92), Scottish traveler and writer, sometimes called Rob Roy; travels through European rivers and lakes with canoe of his own design are described in 'A Thousand Miles in the Rob Roy Canoe': C-114

MacGregor, Robert, or **Campbell, Robert** (1671–1734), celebrated Scottish outlaw, known as "Rob Roy" R-166

McGuffey, William Holmes (1800–1873), American educator M-8–9, *picture* M-8

McGuffey's Reader M-8–9

McGuigan, James Charles, Cardinal (born 1894), Canadian churchman, born Prince Edward Island; ordained priest 1918; appointed archbishop of Regina 1930, of Toronto 1934; assistant at Pontifical Throne and papal count 1943; made cardinal 1946.

Mach (*mäκ*), **Ernst** (1838–1916), Austrian physicist and psychologist; professor of physics at Prague 1867–95, at Vienna 1895–1901; strongly influenced modern scientific and philosophical thought; author of scientific books.

Machado (*mä-chä'dō*), **Gerardo** (1873–1939), president of Cuba 1925–33; second term marked by dictatorial oppression; after downfall a fugitive until 1937 amnesty; died in Miami Beach, Fla.

Machado de Assis (*mạ-shä'thọ thä ạ-sēs'*), **Joaquim Maria** (1839–1908), Brazilian Negro writer, born Rio de Janeiro; won greatest acclaim as a novelist, also wrote short stories, poems, and plays; considered foremost figure of Brazilian literature.

Machen (*măk'ĕn*), **Arthur** (1863–1947), Welsh writer; known for fantasy ('The Hill of Dreams') and for bizarre tales ('Tales of Horror and the Supernatural'); autobiography, 'Things Near and Far'.

McHenry, James (1753–1816), American Revolutionary War patriot, born County Antrim, Ireland; served successively as surgeon, secretary to Washington, and aide to

Lafayette; kept private record of Constitutional Convention where he represented Maryland; signed United States Constitution; secretary of war in Washington's Cabinet.
Machete (*mä-chä'tä*, also *mą-shĕt'* and *mą-shĕt'*), cleaverlike knife used as tool and weapon in Spanish-American countries, *picture* S-484
Machiavelli (*mä-kē-yä-vĕl'lē*), **Niccolo** (1469–1527), Italian diplomat and writer; secretary of Florentine republic; founder of modern science of politics; discarded morality as political principle ('The Prince', idealizing Caesar Borgia, foreshadowed 16th- and 17th-century identification of monarch with state; also wrote history, poetry, comedies
developed politics P-360
Florence, Italy F-148
'The Prince' R-106
Machine (physics), device embodying one or more mechanical principles for the translation of motion M-160–1, *pictures* M-160*a*–1. For practical application, *see also in Index* Machinery
friction in F-296
gyroscopic G-237–8
pendulum P-118
Machine, calculating. *See in Index* Calculating machines and devices
Machine, electrostatic, device for producing static electrification by friction, *picture* E-297
first invented by Von Guericke E-307
Machine age M-13. *See also in Index* Industrial Revolution; Inventions
agriculture and A-59–61, 69, H-268
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Machinery M-13–14, *picture* M-14. *See also in Index* Automatic devices; Inventions; Mechanics; Tools; and the names of various machines
accident prevention S-6–7, 8, 10
agricultural. *See in Index* Agricultural implements and machinery
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clayworking and glassmaking: glass G-121–2, 122*a*–*b*, *pictures* G-120–2*b*; potter's wheel P-393, 400, T-153, *pictures* P-398–9, H-399
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gas turbine, *chart* I-186
jet aircraft engine J-342–4
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windmills W-149
printing and publishing
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Machine tools T-153–4, I-141, 142
plant in Vermont, *picture* V-460
Machlett, Raymond R. (1900–1955), X-ray tube manufacturer, born New York City
Machlett tube X-332
Mach numbers, in physics
aircraft speeds A-99
Machu Picchu, an Inca ruin in mountains in s.-central Peru S-263
Maciejowice (*mäts-yĕ-yō-vĕt'sĕ*), **battle of** (1794), Poles defeated by Russians K-67
Mac'intosh, Charles (1766–1843), Scottish chemist, inventor of processes for making lead acetate, or sugar of lead, and bleaching powder
waterproof fabric R-241
MacIntosh, William (1775?–1825), half-breed Creek Indian chief, born Carroll County, Ga.; leader of Lower Creeks on American side in War of 1812; brigadier general in U. S. Army during Seminole campaigns 1817–18; for signing treaty (1825) ceding lands to whites in defiance of tribal law, he was killed by party of Upper Creeks.
McIntyre, James Francis (Aloysius), Cardinal (born 1886), Roman Catholic prelate, born New York City; in 1940 appointed auxiliary bishop to Cardinal Spellman, New York

archdiocese, became coadjutor archbishop 1946; archbishop of Los Angeles after 1948; created cardinal Jan. 1953.
MacIver (*măk-ī'vēr*), **Loren** (Mrs. Lloyd Frankenberg) (born 1909), painter and illustrator, born New York City; one of Museum of Modern Art's group, Fourteen Americans, exhibited 1946; works symbolic, imaginative, mysterious 'Hopscotch' P-22-3, *picture* P-22
Mack, Connie, real name Cornelius McGillicuddy (born 1862), baseball manager, born East Brookfield, Mass. B-64. *See also in Index* Baseball Hall of Fame, *table*
Mackail', John William (1859–1945), English scholar and critic; professor of poetry Oxford University 1906–11; translations of Greek and Latin literature, with criticisms; married daughter of Burne-Jones
quoted on Cicero L-130
McKay, *Alexander* *(died 1811),* Canadian fur trader of North West Company; accompanied Sir Alexander Mackenzie from Lake Athabaska to Pacific in 1793; joined Pacific Fur Company 1810; murdered by Nootka Indians.
Mackay (*măk'i*), **Clarence Hungerford** (1874–1938), capitalist, born San Francisco, Calif.; son of John W. Mackay; president of several telegraph and cable companies; director Metropolitan Opera Company, New York City.
McKay (*mą-kā'*), **Claude** (1890–1948), Negro writer, born Jamaica; came to U. S. 1912; influence in "Negro literary renaissance" of 1920 ('Songs of Jamaica', 'Harlem Shadows', poems; 'Home to Harlem', novel; 'A Long Way from Home', autobiography).
McKay, Donald (1810–80), naval architect and shipbuilder, born Nova Scotia; emigrated to New York 1827; 1850 built his first clipper ship, *Stag Hound;* other famous clippers: *Flying Cloud,* made San Francisco from New York in less than 90 days; *James Baines,* made Boston to Liverpool in 12 days, 6 hours; *Lightning* held record for greatest day's run under sail, 436 nautical miles.
McKay, Douglas (born 1893), public official, born Portland, Ore.; established auto sales business at Salem, Ore. 1927; service in World Wars I and II; mayor of Salem 1933–34; state senator 1935–37, 1939–41, 1943–45, 1947–49; governor 1949–52; became U.S. secretary of interior 1953–, *picture* E-278d
McKay, Gordon (1821–1903), inventor, born Pittsfield, Mass.; *inventions* of boot and shoe machinery revolutionized that industry: S-163, 164
Mackay (*măk'i*), **John W.** (1831–1902), American capitalist, born Ireland; one of discoverers of Bonanza mines of Comstock Lode in Nevada.
MacKay (*mą-kī'*), **Louis Alexander** (born 1901) (pseudonym John Smalacombe), Canadian poet and educator, born Hensall, near Stratford, Ont. ('The Ill-tempered Lover, and Other Poems').
Mackay, Lake, in central Australia, on the border between Northern Territory and Western Australia, *maps* A-488, 478
Mackaye, Percy (born 1875), dramatist and poet, born New York City; writer of numerous community masques and poetic plays ('Jeanne d'Arc'; 'The Scarecrow'; 'Yankee Fantasies'; 'This Fine-Pretty World'); used Kentucky mountaineer folklore in 'The Gobbler of God', 'Kentucky Mountain Fantasies', and 'Weathergoose—Woo!'
McKean, Thomas (1734–1817), signer of Declaration of Independence, born New London, Pa.; member of Continental Congress 1774–83; governor of Pennsylvania 1799–1808: D-60
signature reproduced D-37
McKean Island, in Pacific. *See in Index* Phoenix Islands
McKeesport, Pa., industrial city on Monongahela and Youghiogheny rivers 12 mi. s.e. of Pittsburgh, in bituminous coal region; pop. 51,502; stainless steel, castings, pipe, tubing, and structural steel: *maps* U-253, *inset* P-132
McKees Rocks, Pa., industrial borough on Ohio River 3 mi. n.w. of Pittsburgh; pop. 16,241; ships considerable lumber; iron and steel products: *map, inset* P-132
McKenna, Joseph (1843–1926), jurist and statesman, born Philadelphia, Pa.; congressman 1885–92; attorney general 1897–98; on U. S. Supreme Court 1898–1926; gained reputation for sound, conservative judgments.
McKenna, Reginald (1863–1943), British statesman; liberal member, House of Commons, 1895–1918; cabinet member; first lord of admiralty, home secretary, chancellor of exchequer; banker after 1919.
McKenna, Stephen (born 1888), English novelist, nephew of Reginald McKenna; writes in entertaining style of British society and political circles ('Sonia'; 'Vindication'; 'The Datchley Inheritance').
Mack'ensen, August von (1849–1945), German field marshal, associate of Ludendorff and Hindenburg in World War I; led decisive offensives against Serbia and Rumania
defeats Rumanians W-226
defeats Russians W-223
Macken'zie, Sir Alexander (1763–1820), Scottish explorer; partner North West Company; first white man to reach Pacific overland: B-316, C-97
Alaska A-137
explores Mackenzie River M-15
leader of North West Company F-324
'Voyages' C-105
Mackenzie, *Alexander* (1822–92), Canadian Liberal statesman, born Scotland; premier 1873–78; administration introduced vote by ballot, created Supreme Court of Canada, organized territorial government of Northwest Territories: C-100
Mackenzie, Sir Alexander Campbell (1847–1935), Scottish composer; principal of the Royal Academy of Music 1888–1924 ('The Rose of Sharon' and 'Bethlehem', oratorios; 'His Majesty', comic opera).
Mackenzie, Compton (born 1883), English novelist, playwright, and poet; served in Dardanelles campaign in World War I; work distinguished for graceful style ('Carnival', dramatized; 'Vestal Fire', 'Sinister Street', 'The Enchanted Blanket', novels; 'The Four Winds of Love', series of novels; 'Kensington Rhymes'; 'Windsor Tapestry').
MacKenzie, Kenneth (1797–1861), a Scottish leader in fur trade; officer in British army in War of 1812; in charge of Fort Union: F-325
McKenzie, Robert Tait (1867–1938), sculptor and physical education director, born Almonte, Ontario, Canada; best known for sculptures of athletes; professor and director of physical education, University of Pennsylvania 1904–30, research professor after 1931; wrote 'Exercise in Education and Medicine'.
McKenzie, Roderick (1761?–1844), Canadian fur trader, born Scotland; emigrated to Canada 1784; built Fort Chipewyan on Lake Athabasca in 1788; his material for history of fur trade used by son-in-law L. R. Masson in 'Bourgeois de la Compagnie du Nord-ouest'; cousin of Sir Alexander Mackenzie.
Mackenzie, William Lyon (1795–1861), Canadian political leader and journalist M-15
Mackenzie, District of, Canada, in w. Northwest Territories; 527,490 sq. mi.: N-298, *maps* C-68, 80–1
Mackenzie River, in n.w. Canada M-15, *maps* C-68, 80, N-245-6, *picture* C-76
length, comparative. *See in Index* Rivers, *table*
valley, agriculture N-298
Mack'erel, a North Atlantic food fish M-15–16, F-114, *picture* M-15
Mackerel, jack. *See in Index* Jack mackerel
Mackerel family (*Scombridae*), large family of spiny-finned, spindle-shaped fish; includes albacore, bonito, mackerel, tuna.
Mackerel shark *S-135*
Mackerel sky C-359
McKim, Charles Follen (1847–1909), architect, born Chester County, Pa.; in partnership with W. R. Mead and Stanford White designed Public Library of Boston, and other important buildings.
Mackinac (*măk'i-nō*), **Straits of,** 4 mi. wide connecting Lakes Michigan and Huron, *maps* M-219, 226
bridge B-308, *picture* M-220. *See also in Index* Bridge, *table*
Mackinac (*măk'i-năk* or *măk'i-nō*), **Island,** Mich., island at n.w. end of Lake Huron in Straits of Mackinac: pop. 572: G-183, M-219, *maps* G-181, M-219, 226, *picture* G-178
Mackinaw, a heavy woolen fabric the two sides of which may differ in color and design; has nap; often plaid; term also short for Mackinaw blanket, boat, and coat.
McKinley, Ida Saxton (1844–1907), wife of President McKinley W-128*b*, M-16
McKinley, William (1843–1901), 25th president of U. S. M-16–20, *picture* M-16
administration (1897–1901) M-18–20,
age of big business M-18–19, U-383
Alaska gold fields discovered A-137, M-19
cartoon, *picture* S-324
Gold Standard Act M-19
Hawaii annexed H-291, M-20
Hay-Pauncefote Treaty M-20
new inventions and a new era M-18–19
open door in China M-19, C-280
Philippine insurrection suppressed P-201
Samoan Islands divided S-35
Spanish-American War S-324–5: Dewey D-77, *pictures* S-324–5
Taft in Philippines T-2
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early career M-16–17
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memorials: Buffalo B-341; Canton, Ohio C-117, M-16; Columbus, Ohio, *picture* O-361
Mount McKinley named for M-16
portrait on $500 bill, *table* M-339
Tariff Act (1890) M-17, H-275, T-18
wife W-128*b*, M-16
McKinley, Mount (native name Denali, or Traleika), Alaska (20,-269 ft.), highest mountain of North America M-16, *map* A-135

height, comparative. *See in Index* Mountains, *table*
national park N-37, M-16, *color picture* N-28, *maps* A-135, N-18

McKinley Tariff Act, U. S. M-17, H-275, T-18

McKinney, Tex., city 30 mi. n.e. of Dallas; pop. 10,560; poultry; cotton gins, textile mill: *map* T-90

MacKinstry, Elizabeth, American artist, illustrator of children's books; work imaginative and humorous ('Fairy Alphabet'; 'Fairy Tales', by Hans Christian Andersen)
illustrations for books, *pictures* L-211, S-406

Mackintosh, Sir James (1765–1832), Scottish scholar and philosopher; moved to London 1788, member of parliament after 1813; author of historical and philosophical works.

MacLar'en, Ian, pen name of *Reverend John Watson (1850–1907)*, Scottish clergyman and author ('Beside the Bonnie Briar Bush').

MacLaughlan, Donald Shaw (born 1876), American etcher, born Canada; lived in Boston, Mass., and in Europe; architectural etchings.

Maclaurin, Colin (1698–1746), Scottish mathematician, born Kilmodan, Argyllshire; proponent of Newton's fluxional calculus ('A Treatise of Fluxions').

MacLeish, Archibald (born 1892), poet, born Glencoe, Ill.; librarian of Congress 1939–44; assistant secretary of state (public and cultural relations) 1944–45; Boylston professor of rhetoric and oratory at Harvard University since 1949; awarded Pulitzer prize in poetry in 1932 for 'Conquistador', epic of conquest of Mexico by Cortez, and in 1953 for 'Collected Poems, 1917–1952'; ('The Fall of the City; a Verse Play for Radio'; 'Land of the Free', free verse; 'Actfive, and Other Poems'): A-230*d*
quoted P-337

MacLennan, (John) Hugh (born 1907), Canadian novelist, born Cape Breton Island ('Barometer Rising'; 'Two Solitudes'; 'The Precipice'; 'Each Man's Son'): C-106*a*

Macleod, Fiona. *See in Index* Sharp, William

McLeod (*măc-loud'*), **John** (1788–1849), Canadian fur trader and explorer, born Stornoway, Scotland; joined Hudson's Bay Company 1811 and conducted first group of colonists to Red River Settlement; active in disputes between Hudson's Bay and North West companies

MacLeod, John James Rickard (1876–1935), Scottish physiologist; professor University of Toronto 1918–28; discovered insulin with Dr. Banting, with whom he shared Nobel prize in 1923.

McLoughlin (*măk-lŏk'lĭn*) **John** (1784–1857), explorer, fur trader, and physician, born Rivière du Loup, Canada O-419–20, B-316
Statuary Hall. *See in Index* Statuary Hall (Oregon), *table*

McLoughlin, Mount, volcanic peak of Cascade Range, in Oregon; near Upper Klamath Lake; 9493 ft.: *map* O-416

Maclure, William (1763–1840), "father of American geology," born Scotland; made first geological map of America 1809, revised 1817; used wealth in support of science.

MacMahon (*măk-mä-ôṅ'*), **Marie Edmé Patrice Maurice de** (1808–93), duke of Magenta and marshal of France; crushingly defeated at Sedan 1870; president of the Third Republic of France 1873–79.

McManus, George (1884–1954), cartoonist, born St. Louis, Mo.; on staff *St. Louis Republic, New York World*, and *New York American;* created comic strips 'Let George Do It', 'Panhandle Pete', 'Snookums', and 'Bringing Up Father'.

MacManus, Seumas (*shā'mŭs*) (born 1869), Irish author of folk and fairy tales, stories of Irish history, poems, plays, born Donegal: S-414

McMaster, John Bach (1852–1932), historian, born Brooklyn; professor American history University of Pennsylvania after 1883 ('History of the People of the United States').

McMaster University, at Hamilton, Ontario, Canada; Baptist; chartered 1887; arts and sciences, nursing, theology.

MacMechan (*măk-mĕk'ăn*), **Archibald McKellar** (1862–1933), Canadian writer and educator, born Kitchener, Ont. (essays: 'The Life of a Little College, and Other Papers'; poems: 'Late Harvest'; stories of Nova Scotia: 'Sagas of the Sea', 'Old Province Tales').

McMeekin, Isabel McLennan (born 1895), author of books for children and adults, born Louisville, Ky.; books for children: 'Journey Cake'; 'Kentucky Derby Winner'; 'Robert E. Lee'.

MacMillan, Donald Baxter (born 1874), explorer and author, born Provincetown, Mass.; professor of anthropology, Bowdoin College; with Peary Arctic expedition 1908–9; since engaged in Far North exploration: *pictures* P-350*a*
Byrd accompanies B-373

McMillan, Edwin Mattison (born 1907), educator and physicist, born Redondo Beach, Calif.; professor of physics at University of California after 1946; with P. Abelson discovered element neptunium 1940; shared 1951 Nobel prize for chemistry with Glenn T. Seaborg for discovery of transuranium elements: P-324

MacMillan, Sir Ernest Campbell (born 1893), Canadian organist, conductor, and composer, born Mimico, Ont.; conductor, Toronto Symphony Orchestra from 1931.

MacMonnies (*măk-mŭn'nĭz*), **Frederick** (1863–1937), sculptor, born Brooklyn; great fountain for Columbian Exposition in Chicago, Battle Monument at West Point: S-81
bronze group, *picture* B-329
Congressional Library doors W-28
Nathan Hale statue, *picture* H-247

McMurray, Alberta, Canada, village on Athabaska River, about 230 mi. n.e. of Edmonton; pop. 621; fur-trading post; airport, railroad terminal; oil reserve and salt beds: A-143, *map* C-81

MacMurray College for Women at Jacksonville, Ill.; Methodist; founded 1846; arts and sciences, business administration, home economics, music; graduate studies.

MacMurrough, Dermot. *See in Index* Dermot MacMurrough

McMurry, Frank Morton (1862–1936), educator, born Crawfordsville, Ind.; professor of elementary education, Columbia University; coauthor, with Ralph S. Tarr and A. E. Parkins, of common school geographies; wrote books for teachers.

McNair, Lesley J. (1883–1944), Army officer, born Verndale, Minn.; formerly chief of staff of General U. S. Army Headquarters; commander U. S. Army Ground Forces 1942–44; killed in action in France.

McNarney, Joseph T(aggart) (born 1893), Army officer, born Emporium, Pa.; on G. H. Q. Air Corps staff 1935–38; on War Dept. general staff 1939–41; deputy chief of staff 1942–44; U. S. commander in Mediterranean area 1944, in Europe 1945; chief U. S. occupation zone in Germany 1945–47; chairman Defense Management Committee 1949–52; retired as general 1952; president Consolidated Vultee Aircraft Corporation after 1952.

McNary, Charles L. (1874–1944), U. S. senator from Oregon after 1917; born Salem, Ore.; Republican candidate for U. S. vice-president 1940; coauthor McNary-Haugen Farm Relief Bill.

McNary Dam, in Oregon, on Columbia River O-410

McNary-Haugen Farm Relief Bill, U. S. C-468

McNary-Woodruff law, U. S. F-240

McNaughton, Andrew George Latta (born 1887), Canadian army officer, born Moosomin, Sask.; veteran of World War I; commander in chief of Canadian overseas force Dec. 1939–Dec. 1943; retired from army as general 1944; defense minister 1944–45; chairman Canadian section International Joint Commission 1950–.

McNeely, Marian Hurd (1877–1930), children's writer, born Dubuque, Iowa; South Dakota life is background of 'Jumping-off Place'.

McNeer, May Yonge (Mrs. Lynd Kendall Ward) (born 1902), author of children's books, born Tampa, Fla.; graduated from Pulitzer School of Journalism, Columbia University; her books include the following, illustrated by her husband, Lynd Ward: 'Golden Flash'; 'California Gold Rush'; 'John Wesley'.

MacNeice (*măk-nēs'*), **Louis** (born 1907), Irish poet and classical scholar, born Belfast; writer and producer for British Broadcasting Corporation since 1941 (poetry—'Agamemnon' of Aeschylus, translation in verse; 'Poems, 1925–1940'; 'Springboard'; 'Holes in the Sky'; prose—'The Poetry of W. B. Yeats').

MacNeil, Hermon Atkins (1866–1947), sculptor, born Chelsea, Mass.; noted for Indian subjects
McKinley memorial, *picture* O-361

McNutt, Paul Vories (1891–1955), political leader, born Franklin, Ind.; dean Indiana University School of Law 1925–33; governor of Indiana 1933–37; head of Federal Security Agency 1939–45, of War Manpower Commission 1942–45; U. S. high commissioner to Philippines 1937–39 and 1945–46, first U. S. ambassador to Philippines 1946–47.

Macomb', Alexander (1782–1841), soldier, born Detroit, Mich.; distinguished himself in War of 1812 at Fort Niagara, Fort George, and Plattsburg, N. Y.; made commanding general U. S. Army, 1828.

Macomb, Ill., city 59 mi. n.e. of Quincy; pop. 10,592; clay and steel products; Western Illinois State College: *map* I-36

Macon, Ga., city in center of state, on Ocmulgee River; pop. 70,252; textiles, clay products, food processing; railroad repair shops; Wesleyan College, Mercer University, Georgia Baptist College: G-79, *maps* G-76, U-253

'Macon', U. S. navy dirigible B-34

Macphail', Agnes Campbell (1890–1954), first woman member of Canadian Parliament; elected 1921; influential worker for disarmament and world peace.

Macpherson (*măk-fẽr'sọn*), **James** (1736–96), Scottish author, pro-

fessed "translator" of the poems of Ossian O-426*b*

McPherson, James B. (1828–64), Civil War general, born Sandusky, Ohio; commanded Army of Tennessee during Sherman's Atlanta campaign; killed in battle before Atlanta.

McPherson College, at McPherson, Kan.; owned by Church of Brethren; founded 1887; arts and sciences.

Macquarie (*ma-kwär'ĭ*) **Island,** more than 900 mi. s.e. of Tasmania, to which it belongs; 170 sq. mi.; visited by seal hunters: *map* W-205

McRae, Milton Alexander (1858–1930), newspaper publisher, born Detroit, Mich.; in 1889 he and Edward W. Scripps began organizing chain of popular newspapers, and in 1897 organized press association which developed into United Press; wrote autobiography, 'Forty Years in Newspaperdom'.

Macramé (*măk-ră-mā'*) **lace** L-78

Macready (*ma-krā'dĭ*), **John A.,** transcontinental flight, *table* A-104

Macready, William Charles (1793–1873), celebrated English tragic actor; Shakespearean roles; toured in U. S. 1826 and 1843–44.

Mac-Robertson Coast, in Antarctica, adjacent to Kemp Coast, on Indian Ocean; named by Sir Douglas Mawson's expedition 1929–31: *map* A-259

Macrofeeders, in animal kingdom A-250*a*–*b*

Macrophages, large phagocytes D-103

McSweeney-McNary Act, U. S. F-240

MacSwin'ey, Terence (1879–1920), Irish leader; lord mayor of Cork; hunger striker against imprisonment for sedition; died of starvation in Brixton prison, London, after fasting 74 days.

McTavish, John George (flourished 1808–19), Canadian fur trader of North West Company; represented the company when Astoria was acquired from the Pacific Fur Company; taken prisoner by Hudson's Bay Company 1819 and sent to England for trial.

McTavish, Simon (1750–1804), Canadian fur trader, born Scotland; one of the founders of the North West Company; interested in eliminating competition among fur traders.

MacVeagh (*măk-vā'*), **Franklin** (1837–1934), merchant and political leader, born Chester County, Pa.; secretary of the treasury 1909–13.

MacVeagh, Isaac Wayne (1833–1917), American lawyer and political leader, brother of Franklin; minister to Turkey 1870–71; U.S. attorney general 1881; ambassador to Italy 1893–97; writer and famous wit.

McWilliams, Carey (born 1905), author and attorney, born Steamboat Springs, Colo.; books on racial minorities and migratory workers ('Factories in the Field'; 'Ill Fares the Land'; 'Brothers Under the Skin'; 'The Great Exception').

Macy, Anne Mansfield Sullivan. *See in Index* Sullivan, Anne Mansfield

Madagas'car, island in Indian Ocean, e. of Africa; 227,700 sq. mi.; pop. 4,463,801; cap. Tananarive: M-20–2, *maps* A-47, 42, *pictures* M-21
houses M-21
lemurs L-162
people M-20, 21, 22
relationships to continent, *maps* A-46–7, 41–2, 39, 51
size, comparative. *See in Index* Islands, *table*
vanilla V-439

'Madama Butterfly', opera by Puccini, story O-391

'Madame Bovary', famous novel by Flaubert, published 1856; the heroine, Emma Bovary, is an irresponsible, selfish, extravagant young woman who, involved in debt and intrigue, poisons herself: N-311

Mad Anthony Wayne W-76–7

Madariaga (*mä-dä-rē-yä'gä*), **Salvador de** (born 1886), Spanish writer and statesman; director Disarmament Section League of Nations (1922–27); professor of Spanish, Oxford 1928–31; ambassador to U.S. 1931, to France 1932–34 ('Shelley and Calderon'; 'Sacred Giraffe', novel; 'Christopher Columbus', biography): S-327

Madden Dam, on Chagres River, Isthmus of Panama P-63

Madder family, or **Rubiaceae** (*ru-bĭ-ā'sē-ē*), a family of plants, shrubs, and trees, including the woodruff, bouvardias, cinchonas, coffee, bedstraw, gardenias, and madder
madder a dye source D-165

Maddox, Richard L. (1816–1902), English physician and inventor
dry-plate photography P-226

Madeira (*ma-dēr'a*, Portuguese *ma-thā'ē-ra*) **Islands,** group off n.w. coast of Africa; owned and governed by Portugal; 314 sq. mi.; pop. 269,179; Madeira Island (pop. 266,-245), is the largest of the group: M-22, *map* A-46

Madeira River, largest tributary of Amazon; flows n.e. 900 mi. from frontier of Bolivia through w. Brazil: *maps* B-288, S-252, 256

Madeira vine, a perennial twining vine (*Boussingaultia baselloides*) of the basella family, native to Ecuador but naturalized in s. U.S. Grows 10 to 20 ft.; leaves fleshy, oval, pointed; flowers tiny, white, in long feathery clusters, fragrant.

Madeleine (*măd-lĕn'*), church in Paris, France P-83*b*, *map* P-83*a*, *pictures* P-84, A-308

Madera, Calif., city 20 mi. n.w. of Fresno; pop. 10,497; wine, olives: *map* C-35

Madero (*mä-dā'rō*), **Francisco** (1873–1913), president of Mexico 1911–13 M-207

Madhya Bharat (*mŭ'dyŭ bä'rŭt*), state in w.-central India; area 46,478 sq. mi.; pop. 7,954,154; winter cap. Gwalior; summer cap. Indore; formed by merger of former princely state, Gwalior, and some of former princely states (including Indore) of Central India agency: *map* I-68*a*

Madhya Pradesh (*mŭ'dyŭ pra-däsh'*), state in central India; area 130,-272 sq. mi.; pop. 21,247,533; cap. Nagpur; formed by merger of the following former units: Central Provinces (with Berar), Bhopal Agency, and many of the princely states of Eastern States agency: *map* I-68*a*

Madison, Dolley Payne Todd (Dolly) (1768–1849), wife of President Madison W-126, M-22, 24

Madison, James (1751–1836), 4th president of U. S. M-22–4, *picture* M-22
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contributor to 'The Federalist' M-23, H-253
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Madison, Wis., named for M-24
portrait on $5000 bill, *table* M-339
wife W-126, M-22, 24

Madison, N.J., borough 11 mi. w. of Newark; pop. 10,417; Drew University: *map* N-164

Madison, S.D., city 38 mi. n.w. of Sioux Falls; pop. 5153; farming; General Beadle State Teachers College: *map* S-303

Madison, Wis., state capital and summer resort in s. center, 75 mi. w. of Milwaukee; pop. 96,056: M-24, *maps* W-173, U-253, *picture* W-165
Capitol, State M-24, *pictures* W-165, 179: murals, *picture* U-341
Four Lakes W-166
university M-24, *picture* W-179

Madison College, at Harrisonburg, Va. state control; for women; founded 1908; liberal arts, education; graduate school in education.

Madison River, one of headstreams of the Missouri, 230 mi. long; rises in Rocky Mountains
in Montana, *maps* M-374, 367, *picture* M-367

Madison Square, New York City, *picture* W-238

Madisonville, Ky., city about 115 mi. s.w. of Louisville; pop. 11,132; farming; coal: *map* K-30

Mädler (*mêd'lẽr*), **Johann Heinrich von** (1794–1874), German astronomer, born Berlin; with Wilhelm Beer made important map of moon 1834–36.

Madman of the North, Charles XII, king of Sweden C-195

Madoera, or **Madura,** island in Indonesia n. of e. Java; area 1762 sq. mi.; pop. 1,962,462: J-328, *maps* E-202, A-407

Madog, or **Madoc, ap Owen Gwynnedd,** (1150?–80?), legendary Welsh prince; said to have discovered America on voyage in 1170.

Madon'na, the Virgin Mary; feast day May 31 (established 1955): M-24–5, J-339–40, *picture* M-25
Cimabue: 'Madonna of the Angels' P-24–5, *color picture* P-25
Della Robbia: Madonna and the angels, *picture* P-396*b*
El Greco: 'The Assumption of the Virgin' P-27*b*, *color picture* P-27*c*
Epstein: 'Madonna and Child' S-73, *picture* S-73
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Giotto: 'Descent from the Cross' P-25–25*a*, *color picture* P-25
Grotto at Lourdes, France, *picture* L-336
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Michelangelo: 'Madonna della Pietà' M-213, *picture* M-213; 'Virgin and Child', *picture* M-214
Moore: 'Madonna and Child' S-73–4, *picture* S-73
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Tiepolo: 'The Rest on the Flight into Egypt' D-138, *picture* D-138
Titian: 'Assumption of the Madonna', *picture* T-139

Madonna lily L-242

Madras (*ma-dräs'*), a state of s. India; area 127,790 sq. mi.; pop. 57,016,002 (area and population

before creation of Andhra state); cap. Madras: M-26, *map* I-68*a*
government study of farm income I-56
Hastings H-280
Madras, India, capital of Madras state; pop. 1,416,056: M-26, *maps* I-54, A-407
captured by French C-352
Madras (*ma-dräs'* or *măd'ras*) **cloth,** a lightweight cotton fabric, usually with stripe effect; also a thin drapery fabric with design formed by floating weft; so named because first made near Madras, India.
Madrid', capital and railway center of Spain; pop. 1,618,435, with suburbs: M-26–8, *maps* E-416, 425, S-312, *pictures* M-26–7
Museum of the Prado. *See in Index* Museums, *table*
siege (1936–39). *See in Index* Siege, *table*
Madrid, University of, largest in Spain and one of the leading institutions of Europe prior to Spanish civil war (1936–39); founded 1508; became chief Spanish university in 1836, when University of Alcalá was moved to Madrid and combined with it.
Mad'rigal, a short lyric poem, generally on the subject of love, usually in 6 to 13 iambic lines, marked by terseness and quaintness of expression. In music the term is applied to a part song for several voices, simple in style with lively rhythms and without accompaniment. *See also in Index* Music, *table* of musical terms and forms
Mad River, in Ohio, 100 mi. long D-25, *map* O-356–7
Madrona, or **madrone,** evergreen tree (*Arbutus menziesii*) of heath family, native to foothills of Pacific coast. Grows 20 to 100 ft.; bark rough, brown; shiny, leathery leaves; tiny white flowers in long, erect clusters; orange-red fruit. Wood is light pink with deep red spots; used as veneer. Also called laurelwood, manzanita, madrono.
Madstones, porous stones popularly believed to absorb poison from the wounds made by mad dogs and venomous snakes.
Madura (*ma-dur'a*), or **Madurai,** India, city in Madras state, 270 mi. s.w. of city of Madras; pop. 361,781; noted for elaborate Hindu architecture: *maps* I-54, A-407
Madura, island in Indonesia. *See in Index* Madoera
Mad widow, a bird. *See in Index* Limpkin
Maeander River, in Asia Minor. *See in Index* Meander River
Maecenas (*mē-sē'nas*), **Gaius** (73?–8 B.C.), wealthy Roman patron of Horace and Vergil; name proverbial as that of liberal patron of letters; in Eugene Field's slang phrase, "Maecenas pays the freight"
Vergil and V-452, *picture* R-181
Maelstrom, or **Malström** (*māl'strŏm*), celebrated whirlpool or current n. of Norway, near s.w. end of Lofoten Islands W-121, *map* N-301
Maerlant (*mär'länt*), **Jacob van** (1235?–1300?), Flemish poet, called "father of Dutch literature"; early work free translations of French romances; later wrote scientific and historical works.
Maes, or **Maas** (*mäs*), **Nicolaes** (1632–93), Dutch portrait and genre painter; pupil of Rembrandt.
Maestricht, Netherlands. *See in Index* Maastricht
Maeterlinck (*mä'tĕr-lingk*), **Count Maurice** (1862–1949), Belgian dramatist and essayist M-28, *picture* M-28
Mafeking (*măf'ĕ-king*), Union of South Africa, town in Cape of Good Hope Province; pop. 6870; trading center for w. Transvaal and Bechuanaland; seat of administration for Bechuanaland Protectorate: *map* A-47
besieged in Boer War B-220. *See also in Index* Siege, *table*
Mafia (*mä'fē-ä*), a powerful Sicilian secret organization S-176
U.S. controversy H-276
Magadi (*mà'gä-dē*) **Lake,** in Kenya Colony, British East Africa, s.w. of Nairobi; about 30 mi. long; large carbonate of soda deposits.
Magallanes, Chile. *See in Index* Punta Arenas
Magazine, a publication M-29–31, *picture* M-29
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printing, *picture* P-413
Magazine Mountain, one of two highest peaks in Arkansas (2800 ft.), 45 mi. s.e. of Fort Smith; Blue Mountain, about 40 mi. s.w., is same height: *map* A-366, *picture* A-360
'Magda' (*măg'dä*), English title of Sudermann's play 'Heimat' (Home); Magda, the heroine, rebels against the rigid tyranny of her father, leaves his house, and later returns an operatic singer.
Magdalen (*mad'lin*) **College** (St. Mary Magdalen), Oxford, England O-434, *picture* O-432
Magdalena (*mäg-dä-lā'nä*), river of Colombia; rises in Andes in s.w., flows n. 1000 mi. to Caribbean at Barranquilla; chief route to interior: C-387, 388, *maps* C-387, S-252, 256
steamer, *picture* S-265
Magdalena Bay, on s.w. coast of Lower California, Mexico; tuna, mackerel, sardines: *maps* M-189, 194
Magdalene. *See in Index* Mary Magdalene
Magdale'nians, people of Old Stone Age, of later culture than Cro-Magnons, name from La Madeleine, France, where remains were found.
Magdalen Islands, Quebec, Canada, in Gulf of St. Lawrence about 54 mi. n.w. of Cape Breton; cod, herring, seal; pop. 9999: *maps* C-69, 73
Magdeburg (*măg'dŭ-burk*), Germany, city on Elbe River, 75 mi. s.w. of Berlin; pop. 236,326; sugar refining, textiles: *maps* G-88, E-416, 424
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World War II, ruins, *picture* G-100
Magee', Augustus W. (1790–1813), American filibuster; graduate U. S. Military Academy (1809); led expedition into Mexican Texas (1812–13) with the Mexican patriot Bernardo Gutiérrez de Lara.
Magellan (*ma-gĕl'an*), **Ferdinand (Fernão de Magalhães)** (*mä-ga-lyä'ĕnsh'*) (1480?–1521), Portuguese navigator, M-31–3, A-188, *picture* M-32, *color picture* M-31
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Magellan, Strait of, Spanish **Estrecho de Magallanes** (*ĕs-trā'chō dā mä-gä-yä'näs*), passage between mainland of South America and Tierra del Fuego; 360 mi. long, from 2 to 20 mi. wide: S-258, *maps* S-253, 256, C-250
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Magellanic Cloud, either of two veil-like appearances (Large Magellanic Cloud and Small Magellanic Cloud) in skies of S. Hemisphere; composed, like Milky Way, of nebulae and star clusters: *chart* S-375
Magendie (*mà-zhăn-dē'*), **François** (1783–1855), early French experimenter in physiology, born Bordeaux, France; distinguished sensory and motor roots of spinal nerves; studied veins and arteries; credited with introducing several drugs into medical practice.
Magenta (*mä-gĕn'tä*), town in n. Italy 15 mi. w. of Milan, scene of battle (1859) I-273
Magenta, a color, *color chart* C-398
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Maggiore (*mäd-gō'rä*), **Lake,** in Switzerland and n. Italy, 83 sq. mi.; famous for scenery: *maps* S-475, I-262, *picture* I-271
Mag'got, a fly larva F-188, *picture* F-188
Maghmela, a Hindu bathing festival held at Allahabad, India, at confluence of Jumna and Ganges rivers.
Magi (*mā'gi*) (from Persian *magu*, meaning "magician"; English singular, *magus*), members of a priestly caste of ancient Medes and Persians. Name is applied also to the "wise men" in the Bible (Matthew ii) who followed the star to Bethlehem. Bible story does not name them nor give their number, but Christian tradition (about 7th century) makes them three kings, Melchior, Gaspar, and Balthazar. Their bodies are said to have been brought to Constantinople by Empress Helen, mother of Constantine, thence taken to Milan, and finally to Cologne in 1162 by Frederick Barbarossa. They are often called the Three Kings of Cologne
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'Magic Flute, The' (1791), opera by Mozart; fantastic story contains allegorical allusions to politics, nationalism, and Freemasonry.
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Magic Skin Baby, a doll D-122
Magic square, device used in teaching arithmetic, *picture* A-341
Maginot (*mà-zhē-nō'*) **Line,** French fortifications F-270, W-248
Magistrate courts C-500
Magliabechi (*mä-lyà-bĕk'ē*), **Antonio da Marco** (1633–1714), Italian goldsmith and scholar, born Florence; prodigy of learning and avid collector of books; librarian to Cosimo III de' Medici: L-183
Magma (*măg'ma*), in geology G-53, R-167, 168, 169, *diagram* G-49
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Magna Grae'cia, in ancient geography, name of Greek settlements in s. Italy and Sicily G-197, *map* G-197
Rome conquers R-184
Magne'sia, battle of (190 B.C.), decisive victory of Romans over Antiochus the Great of Syria at ancient town of Magnesia, Asia Minor, 20 mi. n.e. of Smyrna; brought w. Asia Minor under Roman control.
Magnesia, milk of, emulsion of magnesium hydroxide in water M-41
Magnesian limestone, same as dolomite M-262
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Mag'nesite, or magnesium carbonate M-41
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Magnet Mountain, in the Urals R-277
Magne'to, an electric generator E-291
Magnetom'eter, an instrument for measuring the strength, direction, dip, or all three, of the earth's magnetic field at any point.
petroleum, use in locating P-170
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Magnificat (*măg-nĭf'ĭ-kăt*), from Latin *Magnificat anima mea Dominum*, "My soul doth magnify the Lord," Mary's answer to Elizabeth's greeting; sung in Roman Catholic and Anglican vesper services.
Magnification, in physics, enlargement of an image by a lens L-169, *diagrams* L-165, 168
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Magnifying glass L-169, *diagrams* L-165, 168
Magnitogorsk (*măg-nē-tō-gôrsk'*), city in w.-central Siberia on Ural River; founded 1929 and named for Magnet Mts.; steel mills; pop. 200,000: *maps* R-266, A-406
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Magno'lia, a flowering tree M-43–4, *picture* M-43
state flower of Louisiana and Mississippi, *color picture* S-384*a*
Magnoliaceae (*măg-nō-lē-ā'sē-ē*), the magnolia family of plants.
Magnolia State, popular name of Mississippi.
Magnolia warbler W-7, *color picture* B-162
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Magnus, Albertus. *See in Index* Albertus Magnus
Magof'fin, Beriah (1815–85), governor of Kentucky C-334
Magog. *See in Index* Gog and Magog
Ma'gog, Quebec, Canada, town at n. end of Lake Memphremagog, about 75 mi. e. of Montreal; pop. 12,423: sawmills, textile works; fishing resort: *maps* C-73, *inset* C-69
Mag'ot monkey M-352
Magpie, bird of crow family M-44, *picture* M-44
Magpie mushroom. *See in Index* Coprinus picaceus
Magsaysay (*mŏg'sī'sī'*), **Ramón** (born 1907), Philippine political leader, born Iba on island of Luzon; led guerrilla army against Japanese in World War II; member of Philippine house of representatives 1946–50; secretary of national defense 1950–53; president Dec. 1953–.
Maguey (*măg'wā*), a species of agave M-197, 200, *table* F-63
fiber, preparing, *picture* M-199
Magyar (*măg'yär*, Hungarian *mqd'-yqr*) **language** H-448
Magyarorszag (*mŏd'yŏr-ōr-săg*), native name of Hungary.
Magyars, a Finno-Ugric people appearing in Europe in 9th century; dominant stock of Hungary: H-448. For history, *see in Index* Hungary
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'Mahabharata' (*mq-hä'bä'rq-tq*), Hindu epic I-66
Mahaf'fy, Sir John Pentland (1839–1919), Irish scholar, Greek and Roman historian ('Social Life in Greece from Homer to Menander'; 'Silver Age of the Greek World').
Mahan (*mq-hăn'*), **Alfred Thayer** (1840–1914), Navy officer and historian, born West Point, N. Y.; greatly influenced naval policies of Germany, Great Britain, and U. S. by books 'The Influence of Sea Power upon History'; 'The Interests of America in Sea Power'
quoted N-80
Mahanoy' City, Pa., borough 55 mi. n.e. of Harrisburg in anthracite-mining region; pop. 10,934; shirts, hosiery, tobacco, cigars: *map* P-133
Maharajah. *See in Index* Rajah
Mahdi (*mä'dĭ*), the Mohammedan Messiah: various pretenders have claimed title; Sunnites hold that true Mahdi has not yet appeared; name given particularly to Mohammed Ahmed (1843–85): G-141, S-442*a*
Mahé (*mä-ā'*), settlement on Malabar Coast, India; one of French Settlements in India; 23 sq. mi.; pop. 18,293: *maps* I-68*a*, A-407
Mahican (*mä-hĭ'kăn*), or **Mohican,** Indian tribe and confederacy of Algonquian stock originally living in Hudson Valley, later in Massachusetts, Connecticut, and also Pennsylvania, where most of them were absorbed into the Delaware Confederacy.
Mahieu, Thomas (Italianized **Maioli**) (died 1575?), French book collector; bindings made for him bear the legend "Thomae Maioli et amicorum": B-241
Mahler (*mä'lẽr*), **Gustav** (1860–1911), Austrian musical conductor and composer, born Kalischt, Bohemia; director Court Opera, Vienna; conductor Metropolitan Opera House, New York City, 1907–9, New York Philharmonic Orchestra 1909–11; composed elaborate symphonies.
Mahmud (*mä-mqd'*) **II** (1785–1839), sultan of Turkey, succeeded 1808; suppressed Janizaries; forced to recognize independence of Greece.
Mahmud of Ghazni (971–1030), Afghan conqueror, sultan of Ghazni 997–1030; devout Moslem and famed chiefly for holy invasions of India; these conquests added untold riches to Empire of Ghazni which, during Mahmud's reign, rose to its height of power.
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Mahomet. *See in Index* Mohammed
Mahón (*mä-hōn'*), capital of Menorca, one of Balearic Islands; harbor; Port Mahon nearby; pop. 14,651: *map* E-425
Maho'ning River, rises in e. Ohio, flows s.e. in Pennsylvania joining Shenango River to form Beaver; length 100 mi.
Maho'ny, Francis Sylvester (Father Prout) (1804–66), Irish poet and humorist; expelled from Jesuit Order, took up literary life, writing as Father Prout; 'Bells of Shandon' best-known poem.
Mahout', elephant driver E-327
Mahrattas (*mq-răt'qz*), or **Marathas,** Hindu tribes of central and w. India; conquered and ruled many states, forming strong confederacy 17th and 18th centuries: I-67
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Mährisch-Ostrau, Moravia, Czechoslovakia. *See in Index* Moravska Ostrava

Maia (*mā'ya*), in Greek mythology, daughter of Atlas and mother of Hermes
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'Maid and the Pail of Milk, The', fable F-3
Maidenhair fern F-54
Maidenhair tree, another name for ginkgo tree G-109. *See also in Index* Ginkgo family
Maid Marian, Robin Hood's sweetheart R-164-5
Maid of Orleans, name given to Joan of Arc after her victory at Orleans. *See in Index* Joan of Arc
Maidstone, England, county town of Kent; pop. 54,026; on Medway River, 30 mi. s.e. of London; grain market; Kentish Royalists defeated by Thomas Fairfax 1648: *map* B-325
Maidu (*mī'dọ*), a group of many small Indian tribes of e.-central California; numbered 5000 to 6000 at the time of the gold rush, but now only about 500 survive.
Maikop (*mī'kŏp*), Russia, city in n.w. Caucasia 60 mi. s.e. of Krasnodar; pop. 67,000; oil fields: *maps* R-267, B-204, E-417
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Maillol (*mȧ-yôl'*), **Aristide** (1861–1944), French sculptor; influenced by classicists and postimpressionists; works distinguished for monumental quality and for calm restraint, dignity, and repose: S-81
'The River' S-81, *picture* S-80
Mailomat, *picture* P-388
Mail-order advertising A-25
Mail-order store U-328
Mail plane. *See in Index* Air mail
Maimonides (*mī-mŏn'ĭ-dēz*), or **Moses ben Maimon** (1135–1204), great Jewish rabbi, philosopher, and physician; born Cordova, Spain; fled from persecution and lived in Fez, Acre, Jerusalem, and Cairo; became physician to Saladin; wrote, chiefly in Arabic, medical works, commentaries on the Bible and Talmud; in 'Guide to the Perplexed' sought to harmonize philosophy of Aristotle with Biblical and rabbinic teaching.
Maine, old province in n.w. France, s. of Normandy; chief city, Le Mans: *map* F-270
English fief under Henry II H-335
Maine, northernmost of New England states; 33,215 sq. mi.; pop. 913,774; cap. Augusta: M-45–57, *maps* M-52–3, 46, 49, U-253, 259, *pictures* M-45, 55–6
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'Maine', U. S. battleship S-324, *picture* S-325
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Maine, University of, at Orono, Me.; state control; founded 1865; arts and sciences, agriculture, education, technology; graduate study: *picture* M-55
Maine Turnpike, an express highway M-46
Mainland, largest of Shetland Islands S-148, *map, inset* B-324
Mainland, or **Pomona**, largest of Orkney Islands O-425, *map* B-324
Main River, in s. Germany formed by Red and White Main; has tortuous course w. for 310 mi., joining Rhine opposite Mainz: *map* G-88
canal to Danube River D-15
Frankfort on F-278
Mains, water P-322
early systems W-74
Mainspring, of a watch W-56, 57
'Main Street', a widely read novel by Sinclair Lewis published 1920, picturing the dullness and smugness of a small Midwestern town, "Gopher Prairie." The phrase "Main Street" has since become synonymous with provincialism: A-230*d*
Maintenon (*măṅ-tŭ-nôṅ'*), **Marquise de** (1635–1719), 2d wife of Louis XIV M-57
Mainz (*mīnts*), French **Mayence** (*mȧ-yäṅs'*), commercial and manufacturing city in s.w. Germany on Rhine River opposite mouth of Main; pop. 88,369; head of league of Rhenish towns in 13th century; city greatly damaged in World War II: *maps* G-88, E-425
Gustavus Adolphus at G-234
Maioli (*mä-yō'lē*) **bookbindings** B-241
Maiolica (*ma-yŏl'i-ka*, Italian *mä-yō'-lē-kä*), pottery P-396*b*
Maipo (*mī'pọ*), or **Maipu**, river of Chile; rises in Andes, flows 120 mi. w. to Pacific just s. of Santiago; decisive battle of Chilean War for independence fought on banks (1818).
Mair, Charles (1838–1927), Canadian poet and journalist; his 'Tecumseh', a poetic drama, reveals insight into Indian character.
Maisonneuve (*mē-zôṅ-nûv'*), **Paul de Chomedy, sieur de** (1612–76), founder of Montreal, and its governor for 22 years, born Neuville-sur-Varnes, Aube, France; an able administrator, but removed because of governor general's jealousy: M-380–1, C-95*a*
Maitland, Frederic William (1850–1906), English jurist and historian ('History of English Law'; 'Canon Law in England').
Maitland, Lester J. (born 1898), aviator, born Milwaukee, Wis., *table* A-104
Maitland, Sir Peregrine (1777–1854), English soldier, lieutenant governor of Upper Canada 1818–28 and of Nova Scotia 1828–32.
Maize, name of grain and plant called "corn" in U. S. *See in Index* Corn
Mai'zolith, a rubber substitute made from cornstalks C-484
Majesty, word used to express power and dignity of a sovereign: in Roman state signified supreme authority of ruler. "His or Her Majesty" now applied in Europe to any reigning king or queen, "His or Her Imperial Majesty" to any reigning emperor or empress.
Majolica pottery. *See in Index* Maiolica
Major, Charles (pen name Edwin Caskoden) (1856–1913), lawyer and writer of popular novels, born Indianapolis, Ind. ('When Knighthood Was in Flower'; 'Dorothy Vernon of Haddon Hall').
Major
U. S. Air Force, *table* A-384: insignia, *picture* U-238
U. S. Army, *table* A-384: insignia, *picture* U-238
U. S. Marine Corps, *table* A-384
Major, in music. *See in Index* Music, *table* of musical terms and forms
Majorca, Balearic Islands. *See in Index* Mallorca
Major domus. *See in Index* Mayor of the Palace
Major general
U. S. Air Force, *table* A-384: insignia, *picture* U-238
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Majuba (*ma-gū'ba*) **Hill**, in n.w. Natal, Union of South Africa, where Boers defeated British 1881: T-175
Majuscules (*ma-gŭs'kūlz*), Latin capital letters A-179, B-235
Makah (*mä'kä*), a tribe of Nootka Indians living about Cape Flattery, Wash.
Makalla, Aden Protectorate. *See in Index* Mukalla
Makassar (*ma-kăs'ẽr*), also **Macassar**, seaport and chief city of Celebes, Indonesia, on w. coast of s. peninsula of island; pop. 400,000; source of macassar oil, from seeds of the kusam tree (*Schleichera trijuga*), so widely used as hair ointment in 19th century that tidies to protect chair backs are called antimacassars: *maps* E-202, A-407
Makassar Strait, a channel separating islands of Borneo and Celebes, uniting Java Sea and Celebes Sea, and making a celebrated biological division: *maps* E-202, A-407. *See also in Index* Wallace's Line
Makatea (*mä-kä-tā'ä*), French island of Pacific in w. Tuamotu Archipelago; about 5 by 3 mi.; pop. 1826; phosphate: *map* P-17, *picture* P-14
Make-believe play P-316
Make-ready, in printing P-414*b*
readying multicolor rotary press, *picture* P-414*b*
Make-up, for motion pictures M-420, *picture* M-414
Makhachkala (*mä-käch-kä-lä'*), formerly **Petrovsk-Port**, Russia, port on w. shore of Caspian Sea; pop.

86,847; center of petroleum, rice, silk, and grain trade: *map* R-267
Makino (*mä-kē'nō*), **Nobuaki, Count** (1861–1949), Japanese statesman and diplomat; represented Japan in Versailles Peace Conference 1919.
Malabar (*măl'ă-bär*) **Coast**, name often given to w. coast of India as far n. as Bombay; more strictly confined to s. part
rainfall I-54
Malabar Hill, Bombay B-225
Malacca (*ma-lăk'a*), Federation of Malaya, British territory on w. coast of Malay Peninsula between Singapore and Penang; 640 sq. mi.; pop. 239,356; cap. Malacca (pop. 54,-507): M-60, *maps* I-123, A-407
Malacca, Strait of, channel about 500 mi. long between Sumatra and w. coast of Malay Peninsula M-60, *maps* E-202, A-407
Malacca cane, a species of cane (*Calamus scipionum*) from Malacca and vicinity; of rich brown color; used for walking sticks.
Malachi (*măl'ă-kī*), 39th book of Old Testament and last of minor prophets, written between 464 and 424 B.C.; authorship disputed.
Malachite (*măl'a-kīt*), a bright green copper ore, commonly found massive though occasionally in stalactitic and other forms; chemical formula $Cu_2(OH)_2CO_3$; found in U.S., Cuba, Chile, Rhodesia, Australia, Russia: M-262
a gem stone J-350
'Malade Imaginaire, Le' (*lē mà-làd ē-mà-zhē-när'*), a play by Molière M-333
Malaga (*măl'a-ga*, Spanish *mä'lä-gä*), Spain, manufacturing city and seaport on Mediterranean, 65 mi. n.e. of Gibraltar; pop. 276,222, with suburbs; ships wine, grapes, raisins, olives; taken from Moors by Christians 1487; sacked by French 1810: *maps* S-312, E-416, 425
cathedral, *picture* S-322*a*
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Malagasy (*măl-a-găs'ĭ*), native of Madagascar M-20, 21, *color picture* A-35
Malamute, Alaskan sled dog, *color picture* D-116*a*, *table* D-118*a*
Malan (*ma-län'*), **Daniel François** (born 1874), South African statesman, born in Riebeek West, Cape of Good Hope Province; prime minister of Union of South Africa 1948–54
Nationalist leader S-245
Malang (*mä-läng'*), industrial town in e. Java; trade center for agricultural area; pop. 500,000.
Mal'aprop, Mrs., character in Richard Brinsley Sheridan's play 'The Rivals' constantly using wrong word with sound resembling right one, as "an allegory on the banks of the Nile."
Malar (*mā'lēr*), the cheek bone S-192, *picture* S-192
Mä'laren, Lake, Sweden, extends inland from Baltic Sea at Stockholm; 450 *sq. mi.; contains some* 1200 islands: *picture* S-396
Göta Canal S-462
Malar'ia, disease consisting usually of successive chill, fever, and "intermission" or period of normality
effect on civilization M-400
Panama P-56
quinine a remedy Q-14
spread by mosquitoes M-401–3, *pictures* M-402: Major Ronald Ross demonstrates M-403; mosquito control by spraying, *picture* M-404
Malaspina (*mä-lä-spē'nä*) **Glacier**, largest glacier in Alaska, w. of Yakutat Bay; covers 1500 sq. mi. and has front 70 mi. long: A-131
Malatya (*mä-lä-tē'ä*), or **Malatia**, Turkey, important trade center in e. Asia Minor; pop. 49,077; suffered earthquake 1893; massacre of Armenians 1895: *map* T-215
Malaya, Federation of, also **Malayan Federation**, political unit, nearly all on Malay Peninsula, under British protection; came into existence Feb. 1, 1948, replacing Malayan Union; includes former Federated Malay States, former Unfederated Malay States, and two units (Malacca and Penang, the latter with Province Wellesley) of former Straits Settlements; 50,850 sq. mi.; pop. 4,908,086; cap. Kuala Lumpur: M-57–8, *maps* E-202, A-407, *pictures* M-57–9
flag F-137, *color picture* F-135
relationships in continent, *maps* A-406–7, 411–12
Malayan bear, or **sun bear** B-88, 85
Malayan Federation. *See in Index* Malaya, Federation of
Malayan Union, British protectorate, formed 1946; in 1948 became Federation of Malaya. *See also in Index* Malaya, Federation of
Malay Archipelago. *See in Index* East Indies
Malay Peninsula, or **Malaya**, s.e. projection of Asia M-57–60, *maps* I-123, A-407, 411, *pictures* M-57–9
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Malays, inhabitants of Malay Peninsula and adjacent islands M-58–9, *pictures* M-57, 58, 59, T-137
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East Indies E-204–5
Filipinos P-194
Java J-328
piracy P-272
racial classification R-23, *chart* R-22
Thailand (Siam) S-169
Malay Seas, part of Pacific Ocean including Arafura, Banda, Celebes, Flores, Java, Molucca, and Sulu seas, and Makassar Strait. *See also in Index* Ocean, *table*
Malaysia, name loosely applied to regions in Asia and in Asiatic waters chiefly inhabited by Malays; includes Malay Peninsula, Indonesia, and the Philippines.
Malay States, Federated, British Malaya, on Malay Peninsula, former collective name of states of Perak, Selangor, Negri Sembilan, and Pahang; 27,540 sq. mi.; pop. 2,182,572; designated as part of Federation of Malaya: M-60. *See also in Index* Malay Peninsula; Malaya, Federation of
Malay States, Unfederated, British Malaya, on Malay Peninsula, former collective name of five states, Johore, Kedah, Perlis, Kelantan, and Trengganu; 22,100 sq. mi.; pop. 2,037,750; designated as part of Federation of Malaya. With Brunei, in Borneo, which sometimes has been considered an unfederated Malay State, the total area is about 24,-600 sq. mi.; pop. 2,078,407: M-60. *See also in Index* Malay Peninsula; Malaya, Federation of
Malay tapir T-14, 15
Malbaie, La, Quebec, Canada. *See in Index* La Malbaie
Malbork, Poland. *See in Index* Marienburg
Malcolmson, Anne Burnett (born 1910), author and teacher, born St. Louis, Mo.; has adapted for children the stories of legendary heroes of America in 'Yankee Doodle's Cousins', and from old English ballads she derived 'Song of Robin Hood'.
Malcomia (*măl-kō'mĭ-a*), a genus of annual and perennial plants of the mustard family, native to the Mediterranean region. Low-growing, with narrow gray-green leaves; flowers tiny, 4 petals, white, purple, or red, in loose clusters; used in rock gardens; also called Malcolm stock or Virginia stock.
Malden (*mal'dĕn*), Mass., city on Malden River, 4 mi. n. of Boston; pop. 59,804; rubber boots and shoes, tires, knit and leather goods: *map, inset* M-132
Mal'dive Islands, 540-mile chain of coral islets, grouped into about 20 atolls, in Indian Ocean s.w. of India; area 115 sq. mi.; about 300 of the many hundreds of islands are inhabited; pop. 82,086; cap. Male Island; among the exports are dried fish, coconuts, coir, copra, cowries, palm mats; traditionally a sultanate; from 1953–54 the islands were a republic; in March 1954 the sultanate was restored; a British protected state: *maps* A-407, W-205
Maldon (*mal'dŏn*), England, port on Blackwater River 40 mi. n.e. of London; pop. 9721; Danish victory over English in 991: *map* B-325
Malea, Cape, also **Malia, Cape**, the s.e. extremity of Morea, the s. peninsula of Greece, *maps* G-189, B-23
'Male Animal, The', comedy, *picture* D-129
Malebranche (*màl'bräṅsh'*), **Nicolas de** (1638–1715), French philosopher, follower of Descartes; wrote 'Recherche de la vérité' (Search for Truth).
Malecite (*măl'ē-sīt*), division of the Abnaki group, of Algonquian stock; lived in Canada and Maine.
Malenkov (*mŭl-yĕn'kŭf*), **Georgi M(aksimilianovich)** (born 1902), Russian government official, born Orenburg (now Chkalov), Russia; fought in Red army 1919–20; became secretary of Central Committee of Communist party and member of Orgburo 1939; elected alternate member of Politburo 1941, full member 1946; in charge of Russia's airplane and tank production in World War II; premier and chairman of the Presidium of the Council of Ministers 1953–55; deputy premier 1946–53 and 1955–; minister of electric power stations 1955–: S-362, R-292*a*, *b*, *picture* R-292*a*
Maleo (*măl'ē-ō*), Australian bird of megapod family, *color picture* B-176
Malherbe (*màl-ĕrb'*), **François de** (1555–1628), French poet, critic, and courtier; verse about royal persons and state events; poetry and criticism influenced development of French classicism: F-287
Malia, Cape. *See in Index* Malea, Cape
Malibran (*mà-lē-bräṅ'*), **Maria Felicita** (1808–36), French operatic contralto, daughter of Manuel Vicente García; dramatic personality and voice of unusual quality and range made her immensely popular in London and Paris opera.
Ma'lic acid, an organic acid found in juices of certain plants and fruits, such as apples, gooseberries, rhubarb, and grapes.
Malik (*mä'lēk*), **Jacob A.** (born 1906), Russian diplomat, born Kharkov, Russia; ambassador to Japan 1942–45; deputy minister of

foreign affairs 1946–53; U. N. delegate 1948–52; appointed ambassador to England 1953: *picture* U-394
Malines, Belgium. *See in Index* Mechelen
Malines, or **maline** (*ma-lēn'*), silk net similar to tulle but stiffer; used in millinery.
Malinowski, Bronislaw, (1884–1942), English anthropologist, born Poland; professor of anthropology at University of London after 1927; visiting professor at Yale University 1940–41; member of Mond expedition to New Guinea and Melanesia 1914 ('The Family among Australian Primitives'; 'Argonauts of Western Pacific', 'Foundations of Faith and Morals').
Malipiero (*mäl-ē-pē-ā'rō*), **Gian Francesco** (born 1882), Italian composer, born Venice; a leader among Italian modernists.
Mall, The, London, England L-304, *map* L-300–1
Mall, The, park in Washington, D.C. W-31–2, *map* W-30, *picture* W-33
Mal'lard, a common river duck (*Anas platyrhynchos*) D-158, 159, 162, *pictures* D-158, 159, 161, N-55, *color picture* B-180
egg, *color picture* E-268*a*
trap, *picture* B-192
Mallarmé (*ma-lär-mā'*), **Stéphane** (1842–98), French poet, born Paris; taught English; one of leaders of symbolist school of poetry; work often obscure
friend of Debussy D-28
Malleabil'ity, property of a substance by which it withstands hammering *or rolling into thin sheets, often* called foil or leaf, without breaking
aluminum A-182
cohesive forces explain M-142*c*
copper C-473
gold G-133, *pictures* G-134
silver S-188
tin T-137
Mal'lee bird, an Australian megapod
egg hatching E-268
Malleus (*măl'ē-ŭs*), or **hammer**, bone of ear E-170, S-192, *pictures* E-170–1
Mallophaga (*mă-lŏf'ā-ga*), an order of parasitic insects I-160*a*
Mallorca (*mäl-yôr'kä*), or **Majorca** (*ma-gôr'ka*), largest of Balearic Islands (Spanish): 1330 sq. mi.; cap. Palma: B-20, *maps* S-312, E-416
flag. Middle Ages F-136*d*, *color picture* F-133
maiolica, pottery P-396*b*
Mallory, Stephen Russell (1813–73), American lawyer and political leader, born Trinidad, West Indies; U.S. senator from Florida 1851–61; as secretary of navy of Confederacy he urged building of ironclad warships; political prisoner for 10 months at close of war.
Mallow. *See in Index* Malvaceae
Malmaison (*mal-mē-zôn'*), **La**, château near Paris, home of Empress Josephine, later of Empress Eugénie.
Malmédy (*mal-mā-dē'*), town and district in e. Belgium, 25 mi. s.e. of Liége; ceded by Germany 1919; regained by Germany 1940; liberated by U. S. 1944: *map* B-111
Malmö (*mäl'mû*), Sweden, seaport and industrial city on s.w. coast; pop. 192,498; ferry to Copenhagen: S-463, *maps* N-301, E-416, 424
Malnutrition
importance of vitamins V-494–8
neuritis caused by N-113
Malope (*măl'ō-pē*), an annual plant (*M. trifida*) of the mallow family, native to the Mediterranean. Hairy, growing to 3 ft.; leaves in 3 parts with heart-shaped base; flowers rose, purple, or white, veined in dark color, 2 to 3 in. across, with 3 large heart-shaped leaves holding each blossom.
Mal'ory, Sir Thomas (died 1470?), translator, compiler, and author (in part) of first notable English prose romance, 'Morte d'Arthur', printed by Caxton press in 1485 A-394
place in literature E-376
Malpas Tunnel, in France T-210
Malpighi (*mäl-pē'gē*), **Marcello** (1628–94), Italian physiologist, born near Bologna; one of first to apply microscope to study of animal and vegetable structure and to study the anatomy of the brain
demonstrates blood circulation B-210
Malpighian tubes, appendages of alimentary canal of insects, serving the function of kidneys.
Malplaquet (*mal-plä-kê'*), France, village near Belgian frontier, scene of French defeat (1709) in War of Spanish Succession.
Malraux (*mal-rō*), **André** (born 1901), French writer, born Paris; novels deal with death and revolution ('Man's Fate'; 'Days of Wrath'; 'Man's Hope'); also wrote 'The Psychology of Art' and 'The Voices of Silence: Man and His Art'.
Malström. *See in Index* Maelstrom
Malt M-60
alcohol made from A-146
breadmaking B-295
vinegar V-474
Malta (*mạl'tạ*), British colony in Mediterranean; 122 sq. mi.; pop. 305,991; chief island Malta (95 sq. mi.) used as naval base: M-60, *maps* I-262, E-416, 425
Malta, Knights of. *See in Index* Knights of Malta
Malta fever. *See in Index* Undulant fever
Malt'ase, starch-digesting enzyme, in saliva D-91*b*, 92, *table* E-389
Maltese, a small dog native to Malta D-116*c*, *table* D-119
Maltese cat C-136*a*
Maltese pigeon, or **hen pigeon**, *picture* P-254
Malthus (*măl'thŭs*), **Thomas Robert** (1766–1834), English economist, author of Malthusian Theory; also important 'An Inquiry into the Nature and Progress of Rent'
influence on Darwin D-19
Malthu'sian Theory, theory advanced in Malthus' 'Essay on Population' that population, increasing in geometrical ratio, tends, unless checked, to outrun subsistence, which increases in arithmetical ratio.
Malt'ose, a double (disaccharide), sugar ($C_{12}H_{22}O_{11}$) formed by enzymes from starch, reducible to glucose; differs from lactose and sucrose in structure of molecule; about one third as sweet as cane sugar: S-446
Malungeons. *See in Index* Melungeons
Malus (*mă-lŭs'*), **Étienne Louis** (1775–1812), French physicist, born Paris, France; famed for discovering polarization of light by reflection.
Malvaceae (*măl-vā'sē-ē*), the mallow family, a large group of plants, shrubs, and trees, usually with large showy flowers; among plants included are the cotton plant (*Gossypium*), okra or gumbo, marsh mallow, hollyhock, rose of Sharon, abutilon, and rose mallow.
Mal'vern, fashionable inland resort in w. England, 7 mi. s.w. of Worcester; pop. 21,681; on e. side of Malvern Hills: *map* B-325
Malvern Hill, battle of, the last of the Seven Days' Battles of the Civil War, July 1, 1862; fought on n. side of James River 15 mi. s.e. of Richmond; Confederates defeated: C-334, *map* C-335
Malvo'lio, in Shakespeare's comedy 'Twelfth Night', Olivia's solemn, pompous steward, who becomes a center of practical jokes.
Malvy (*mal-vē'*), **Louis Jean** (1875–1949), French political leader of Radical Socialist group; member of *Chamber of Deputies. Accused of* treason 1917; acquitted, but banished for 5 years on verdict of criminal negligence; re-elected to Chamber 1924; minister of interior 1926; chairman finance committee 1928.
Mamaki (*mä-mä'kē*), a paper mulberry tree (*Pipturus albidus*) of the nettle family found only in Hawaii.
Mamaroneck (*ma-măr'ō-nĕk*), N. Y., a town on Long Island Sound which includes the villages of Larchmont and Mamaroneck, 23 mi. n.e. of New York City; pop. 15,016; rubber coats, clothing, food products: *map, inset* N-205
Mamil'ius, Octavius, leader of Latin revolt R-182
Mamma'lia, the mammal class of vertebrates, *Reference-Outline* Z-364
Mammals, vertebrate animals that suckle their young M-60–2, *pictures* M-61
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prehistoric. *See in Index* Animals, prehistoric, *subhead* mammals
reptile ancestors R-110, E-451
winged: bat B-77–9, *pictures* B-77–9
Mammary gland, milk-secreting organ in mammals; undeveloped in males.
Mam'mon, riches, or the god of riches and cupidity; term used in the New Testament.
Mam'moth, an extinct mammal M-62, *pictures* M-62, 65, E-322, P-407
frozen meat preserved until 1901 F-222
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Mammoth Hot Springs, Yellowstone National Park Y-338, *map* Y-338, *picture* Y-337
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Man, Isle of, in Irish Sea; 221 sq. mi.; pop. 55,213: M-71, *maps* B-321, 325
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Manado, or Menado, seaport, n.e. Celebes; pop. 50,000: C-159, *maps* E-202, A-407
Managed currency, a monetary system in which the government regulates the flow of money to influence business conditions R-207, M-339
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Managua (*mä-nä'gwä*), capital of Nicaragua, 30 mi. from Pacific coast, on Lake Managua; pop. 109,352; manufacturing and commercial center: N-233, *maps* C-172, N-251
Manama (*mä-nä'mä*), capital and commercial center, Bahrein Islands; pop. 39,648: *map* A-285
'Man and Superman', play by George Bernard Shaw modernizing the Don Juan legend; John Tanner, although opposed to love and marriage, is finally captured by Ann Whitefield, proving that in love woman, not man, is the pursuer.
Manas'sas, Va., village 25 mi. s.w. of Washington on Bull Run Creek; pop. 1804: *map* V-487
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Manasseh (*ma-năs'ĕ*), Hebrew tribe descended from Manasseh, elder son of Joseph: occupied central Palestine e. and w. of Jordan River.
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Manaus, or Manáos (*ma-nouz'*), capital of Amazonas, n.w. Brazil, on Rio Negro 10 mi. from Amazon; pop. 110,678: *maps* B-288, S-252, *pictures* B-292, A-185
Manca de Vallombrosa. *See in Index* Morès
Mance, Jeanne (1606–73), French foundress (1644) of the Hôtel-Dieu, first hospital in Montreal M-381
Manchester, Conn., manufacturing town with large silk and velvet mills, 9 mi. n.e. of Hartford; pop. of township 34,116; cotton and woolen goods, needles, paper: *map* C-445
Manchester, England, seaport; pop. 703,175: M-71, E-350, 354, *maps* B-325, *inset* B-324
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Manchester, N.H., largest city in state, in s., on Merrimack River; important manufacturing center; pop. 82,732; St. Anselm's College (men): N-144, *maps* N-151, U-253

MANDATED TERRITORIES

German colonies and parts of the Turkish Empire were assigned at close of World War I to various powers under mandates (treaties of trust) for the League of Nations. They were assigned as follows:

To Great Britain: Iraq (mandate ended 1932), Trans-Jordan (mandate ended 1946), Palestine (mandate ended 1948), Nauru Island, Tanganyika Territory, parts of Togo and the Cameroons.

To Union of South Africa: South West Africa.

To France: Syria (mandate ended 1946), parts of Togo and the Cameroons.

To Belgium: Ruanda-Urundi, part of former German East Africa.

To Australia: Northeastern New Guinea and adjacent islands.

To New Zealand: Western Samoa.

To Japan: all German islands in Pacific north of equator (mandate ended with close of World War II).

After the League of Nations expired, some of these territories became trusteeships under the United Nations. *See also in Index* Trusteeships

Manchester College, at North Manchester, Ind.; founded 1889 by Church of the Brethren; arts and sciences.
Manchester Ship Canal, between Manchester and Liverpool C-108a, M-71. *See also in Index* Canal, *table*
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Manchukuo, also Manchoukuo (both pronounced *măn'chụ'kwō'*), former state composed of old Manchuria and Jehol; area about 500,000 sq. mi.; pop. (1940) about 43,200,000; cap. was Hsinking (Changchun): M-71, 76, J-321, C-283
Manchuria (*măn-chụr'ĭ-a*), region in e. Asia s. of Siberia, part of China; pop. 36,903,000: M-71–6, A-416, *maps* M-72, A-406, *pictures* M-73–6, *Reference-Outline* C-286
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Manchus, a nomadic Mongolo-Tatar people from Manchuria; probably of mixed origin; conquered China, ruling from 1644 to 1912; still found in Manchuria: M-75
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Man'co (1500?–1544), Inca leader, set up by Pizarro as sovereign of Peru.
Mandalay (*măn'da-lā*), chief town in Upper Burma, on Irrawaddy River; pop. 163,243; silk manufactures: B-361, *maps* I-123, A-407, *picture* B-360
Man'dan, tribe of Sioux Indians originally living along lower Missouri River; later driven n. to North Dakota: *map* I-106f, *table* I-107
 earth lodge, *pictures* I-104, 104a
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Mandan, N. D., city on Heart and Missouri rivers, 7 mi. w. of Bismarck; pop. 7298; oil industries, dairy products, flour; livestock market; railroad division point; lignite deposits: *maps* N-288, U-252
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Man'deville, Sir John (Jehan de Mandeville), reputed writer of a popular 14th-century book of Eastern travels, written in French; book is now thought to have been compiled from earlier works by Jean de Bourgogne: B-232, *color picture* B-233
Man'dible (from Latin *mandere*, to chew), term applied to: (1) chewing jaws of insects and other arthropods; (2) the lower jawbone of mammals; (3) the upper or lower part of a bird's beak
 insects I-155
 lower jawbone S-192
Mandin'go, a large group of Negroes mixed with Hamites, dwelling in w. Africa from the Senegal River to Monrovia and numbering millions; they are Mohammedans and have attained a certain degree of culture under Arab teachers.
Man'dolin, stringed musical instrument M-76, *picture* M-471
Man'drake, or mandrag'ora, a plant of the nightshade family M-77
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Man'drill, an African baboon B-1–2, *picture* M-352
Man-eater, or great white shark S-134, *picture* S-134
Man-eating tree, a mythical tree frequently mentioned by writers of "tall tales" and located by them either in forests of Madagascar or

the jungles of Mindanao Island in the Philippines. This tree is said to have a dark gray smokestack-like trunk and green leaves at the ends of vinelike stems. With a crackling noise the entire tree is said to bend over and the leaves reach out to grasp the passer-by.

Manes (*mā'nēz*), name applied by ancient Romans to spirits of ancestors and friends in the underworld; also to deities of the lower regions.

Manet (*mȧ-nĕ'*), **Édouard** (1832–83), French painter, born Paris; founder of impressionism and of the "open air," or *plein air*, school, called most original painter of latter 19th century; works criticized for years, but finally attained high recognition ('Olympia'; portrait of Émile Zola; 'Boy with the Sword'): P-31*b*
'The Dead Toreador' P-31*b*, *color picture* P-31*b*

Man'etho, Egyptian historian of 3d century B.C.; *fragments of his work survive in Josephus*: E-278*b*

Mangabey (*măn'gạ-bā*) **monkey**, *picture* M-348

Man'gan, James Clarence (1803–49), Irish poet, a morbid genius who expressed the tragedy of Irish aspirations ('Romances and Ballads of Ireland'; 'The Nameless One', autobiographical ballad): I-234

Manganese (*măn-gạ-nēs'*), a metallic chemical element M-77, C-217, *tables* P-151, M-176, C-214
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Manganese brass B-285

Manganese dioxide, or **pyrolusite**, a compound (MnO_2) of manganese and oxygen
depolarizes electric dry cells B-80, *diagram* B-79

Manganese spar, an ore found in rhodonite. *See in Index* Rhodonite

Mangbetu, Mangbettu, or **Mangbattu**, Negro people dwelling near the headwaters of the Uele, *color picture* A-35

Mange, an itching skin disease of domestic animals due to mites S-347

Man'gel, or **mangel-wurzel**, a beet B-102

Manger scene, in Christmas celebrations C-293–4, *picture* C-293, *color picture* C-292

Mangin (*mäṅ-zhăṅ*), **Charles M. E.** (1866–1925), French general; corps commander at Verdun 1916; 6th Army commander in Aisne offensive 1917 ('Comment finit la Guerre', masterly review of World War I).

Man'go, a fruit M-77

"Mangoes," pepper relish P-143

Man'gosteen, East Indian fruit F-304

Mangravite (*măn-grä-vē'tä*), **Peppino** (born 1896), American artist, born Italy; teacher and writer on art and art education; in U. S. after 1915; works suggestive of Matisse.

Mangrove, a tree M-77
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coon oysters grow on roots O-438
Florida F-164

Manhattan, Kan., city in agricultural region 106 mi. w. of Kansas City on Kansas River, at junction with Big Blue; pop. 19,056; dairying, poultry and stock raising; Kansas State College of Agriculture and Applied Science: *map* K-11
Anderson Hall, at Kansas State College, *picture* K-15

Manhattan, Borough of, part of New York City (Manhattan and several small islands); pop. 1,960,101: N-216–23, 226, *maps* N-222, *inset* N-204

Manhattan Beach, Calif., city 14 mi. s.w. of Los Angeles, on Pacific; chiefly residential; pop. 17,330: *map, inset* C-35

Manhattan Bridge, New York City, over East River, *picture* N-221. *See also in Index* Bridge, *table*

Manhattan College, at New York City; Roman Catholic; for men; founded as an academy 1853; chartered as a college 1863; arts and sciences, business administration and physical education, civil and electrical engineering; graduate studies.

Manhattan Indians, tribe of Wappinger confederacy that occupied Manhattan Island, New York City.

Manhattan Island, New York City N-215, 217, *maps* N-222, *inset* N-204

Manhattanville College of the Sacred Heart, at Purchase, N. Y.; Roman Catholic; for women; founded 1841; arts and sciences; music (open to men).

Manichaeism (*măn'i-kē-ĭzm*), a religion founded in the 3d century A.D. by Mani, a Persian philosopher, taught that the world was created by two principles, Good (the Kingdom of Light) and Evil (the Kingdom of Darkness), that man's soul was good, his body evil. Manichaeism was influenced by Zoroastrianism and other oriental religions as well as by Christianity. In the 4th and 5th centuries, the "Manichaean heresy" in n. Africa was a strong rival of Christianity; Saint Augustine was a Manichaean before conversion.

Manifest destiny, term popular in 1840's and 1850's implying the inevitable expansion of United States territory: C-98, P-12

Manil'a, capital of Philippine Islands until 1948, when Quezon City was declared official capital (with governmental functions to continue in Manila until completion of Quezon City); pop. 983,906: M-77, *maps* P-195, A-531, P-16, *pictures* P-202, T-170*b*
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Manila Bay, Philippine Islands, inlet of China Sea in island of Luzon; fortified harbor: M-77

Manila Bay, battle of (1898) D-77, S-324

Manila hemp P-199, H-333, *pictures* R-228, H-333
rope and twine from R-227–9, *pictures* R-228–9

Manil'ius, Gaius, Roman tribune of the people in 66 B.C., whose proposal to give Pompey supreme command and unlimited power in the war against Mithridates was supported by Cicero in the famous oration 'Pro lege Manilia'.

Man in the Iron Mask, The I-249

Manioc. *See in Index* Cassava

Man'iple, in Roman Legion W-9, *diagram* W-8

Manipur (*mŭ'nĭ-pụr*), state in n.e. India; area 8628 sq. mi.; pop. 577,635; cap. Imphal; formerly an Assam state: *map* I-68*a*

Manisa (*mä'nē-sạ*), also **Manissa**, city in w. Turkey 20 mi. n.e. of Smyrna; pop. 35,019; ancient Magnesia, where Roman consul Scipio Asiaticus defeated Antiochus the Great 190 B.C.: *maps* T-215, E-417

Manistee', Mich., shipping port on Manistee River and Lake Michigan, 95 mi. n.w. of Grand Rapids; pop. 8642; large salt plant and lumber interests; chemicals, paper, clothing: *maps* M-227, U-253
wandering sand dune S-38

Manito'ba, a prairie province of Canada; 246,512 sq. mi.; pop. 776,541; cap. Winnipeg: M-78–81, *maps* C-68–9, 81, *pictures* M-78–80
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Red River of the North R-88
shield F-136*a*, *color picture* F-131

Manitoba, Lake, in s.-central Manitoba, Canada; length 110 mi.; drains into Lake Winnipeg through Dauphin River: M-78, *maps* C-68, 81
Indian legend M-80

Manitoba, University of, at Winnipeg, Manitoba, Canada; founded 1877; arts and sciences, agriculture, architecture, commerce, education, engineering, home economics, interior decoration, medicine, music, nursing education, pharmacy, social work; several affiliated denominational colleges.

Manitou'lin, rugged island of Ontario, Canada, in Georgian Bay, Lake Huron; 80 mi. long; pulpwood; tourist trade: *maps* G-181, C-72

Manitou Springs, Colo., health and pleasure resort at foot of Pikes Peak; pop. 2580; entrance to Garden of the Gods and Cave of the Winds; medicinal springs: *map* C-409

Manitowoc', Wis., city and port on Lake Michigan, 74 mi. n. of Milwaukee; pop. 27,598; aluminum, boilers, furniture, cement, wood products; shipbuilding yards: *map* W-173
car ferry M-230

Maniu (*mä-nē-yọ'*), **Julius** (born 1873), Rumanian statesman; organized revolts in Transylvania at close of World War I; elected head of local government of Transylvania after its union with Rumania; leader of National Peasant party after 1926; premier 1928–April 1931, Oct. 1931–33; sentenced to prison for life by Communist-led Rumanian government November 1947.

Manka'to, Minn., city with large stone-quarrying interests, 72 mi. s.w. of St. Paul on Minnesota and Blue Earth rivers; center of farming, dairying, and stock-raising district; pop. 18,809; State Teachers College; threatened by Sioux uprising 1862: *maps* M-287, U-253

Manley, John (1733–93), American Navy officer, born at Torquay, England; notable services in Revolutionary War when he commanded in turn the *Lee*, the *Hancock*, and the *Hague*.

Key: cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wŏn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn; *out*;

Manlius Capitolinus, Marcus (died 384 B.C.), Roman patrician, consul 392 B.C.; aroused by cackling of sacred geese, he saved Capitol at Rome from the Gauls 390 B.C.; convicted of treason, sentenced to be thrown from Tarpeian Rock.

Manlius Imperiosus Torquatus, Titus, Roman dictator (353 and 349 B.C.) and consul; received part of name for taking chain (*torques*) from gigantic Gaul whom he slew in single combat; had son slain for disobeying military orders.

Mann, Gother (1747–1830), Canadian military engineer, born Kent, England; 1785–91 and 1794–1804 commander of Royal Engineers in Canada; improved fortifications and communications.

Mann, Heinrich (1871–1950), German novelist, brother of Thomas Mann; works show a feeling for beauty and power of satire; in U. S. after 1940 ('Mother Mary'; 'The Little Town'; 'The Patrioteer'; 'The Blue Angel'; 'Madame Legros', play).

Mann, Horace (1796–1859), American educator and publicist M-81, E-255
Hall of Fame, *table* H-249

Mann, Thomas (born 1875), American novelist, born Lübeck, Germany, of aristocratic merchant family; master of characterization and literary craftsmanship; leisurely style; ironic touches but with strong human sympathy dominating; Nobel prize for literature 1929; left Germany because of opposition to Nazis; in U.S. after 1938 ('Death in Venice'; 'Buddenbrooks'; 'The Magic Mountain'; 'Joseph' series of 4 novels; 'The Beloved Returns'; 'Doctor Faustus'): N-311, *picture* G-85

Manna, sweet substance exuded, after incision, from trunk of manna ash tree (*Fraxinus ornus*) and forming commercial product in Sicily; used in medicine. The name manna is also given to similar substances obtained from various plants and trees and also to a desert lichen (*Lecanora esculenta*). The manna referred to in the Bible (Exod. xvi) as the food on which the Israelites lived in the wilderness is now believed to have been a secretion of the tamarisk tree caused by insect puncture.

Manna gum, a eucalyptus tree E-413

Mannerheim (*măn'ẽr-hīm*), **Carl Gustaf Emil, baron von** (1867–1951), commander in chief of Finnish army during World War II; president of Finland 1944–46.

Mannerheim Line, Finland, fortifications along Karelian Isthmus, between Gulf of Finland and Lake Ladoga; built by Carl Gustaf von Mannerheim.

Manners E-404–11. *See in Index* Etiquette

Mannheim (*măn'hīm*), in Württemberg-Baden, s.w. Germany, commercial city on upper Rhine River; pop. 245,634: *maps* G-88, E-416, 425

Manning, Frederic (1882–1935), Australian author, born Sydney; lived in England after World War I: E-382*b*–3

Manning, Henry Edward, Cardinal (1808–92), English High Church leader; became Roman Catholic 1851, and made cardinal 1875; ardent supporter of doctrine of papal infallibility.

Manning, William Thomas (1866–1949), American Episcopal bishop, born England; rector Trinity Parish, New York City, 1908–21; bishop of New York 1921–46.

Mannyng, Robert, of Brunne (flourished 1288–1338), English poet, born Brunne (now Bourne) near Stamford, England; known for 'Handlyng Synne', adaptation in verse of William de Wadington's 'Le Manuel des Pechiez'.

Man-of-war fish, a fish (*Nomeus gronovii*), about three inches long, common in the Gulf of Mexico; seeks refuge among the poison tentacles of large jellyfish, particularly of Portuguese man-of-war.

Manometer (*mȧ-nŏm'ē-tẽr*), instrument for measuring pressure of air, gases, or vapors; barometer one type: V-434, *picture* G-29
ship's log L-295

'Manon' (*mȧ-nôṅ'*), opera by Massenet
story O-391

'Manon Lescaut' (*lĕs-kō'*), opera by Puccini
story O-391

Manor (*măn'ẽr*), in feudal times, the estate of a lord F-61, *picture* M-238

Manor house, England A-318, E-365, *picture* E-356

Man o' War, famous race horse in U.S.: died 1947 at age of 30.

Man-o'-war bird, or **frigate bird** F-297, *pictures* F-297, G-4

Manpower Commission, War (WMC), U. S. R-215

Mansard roof. *See in Index* Architecture, *table* of terms

Mansart, or **Mansard** (*măṅ-sȧr'*), **Jules - Hardouin** (1646?–1708), French architect; works include the dome of the Invalides and the Place Vendôme, Paris; at Versailles, the palace (in large part), gardens, and Grand Trianon. He was a grand nephew of François Mansart (1598–1666) for whom the Mansard roof was named.

Mansfield, Katherine (1888–1923) (Mrs. J. Middleton Murry), British writer of short stories, born Wellington, New Zealand; reveals human character with penetrating insight through ordinary actions and situations; artistic craftsmanship ('Bliss'; 'The Garden Party').

Mansfield, Richard (1857–1907), American actor, born in Berlin, Germany, while his mother, a singer, was on an opera tour; first roles were light opera in London; began stage career in America 1878; technique made him successful in wide variety of parts ('Beau Brummel'; 'Dr. Jekyll and Mr. Hyde'; 'Peer Gynt'; 'Cyrano de Bergerac'; and Shakespearean roles); first to stage Shaw's plays in America.

Mansfield, England, town in Nottinghamshire, 49 mi. s.e. of Manchester; pop. 51,343; center of coal-mining district; lace, thread, footwear; surrounded by remains of Sherwood Forest: *map* B-325

Mansfield, Ohio, industrial city 65 mi. s.w. of Cleveland; pop. 43,564; steel and brass goods, farm machinery, stoves, auto tires; large trade in farm products: *maps* O-356, U-253
Johnny Appleseed saves A-278

Mansfield, Mount, in Green Mts., highest point in Vermont, 4393 ft., *maps* V-457, N-144, *picture* U-258

"Man's first disobedience," quotation from John Milton M-259

Manship, Paul (born 1885), sculptor, born St. Paul, Minn. ('Dancer and Gazelles'; 'Indian and Pronghorn Antelope'; portrait bust of Rockefeller): S-82
'Diana' S-82, *picture* S-81

Mansion House, London residence of lord mayor L-301, *map* L-301

Manslaughter, in law. *See in Index* Law, *table* of legal terms

Manson, Sir Patrick (1844–1922), English physician, pioneer in tropical medicine; one of first to suggest that mosquito was active agent in spread of malaria.

Mansura (*măn-sọ'rä*), Egypt, town on Nile delta 70 mi. n. of Cairo; pop. 102,709; cotton; battle between Crusaders under Louis IX of France and Egyptians 1250; Louis imprisoned: *map* E-271

Mansyu Deep, in Pacific Ocean P-2

Manta, or **devilfish** S-190

Mantegna (*män-tān'yä*), **Andrea** (1431–1506), Italian painter ('Triumph of Caesar'; 'Madonna della Vittoria')
engraving E-387

Mantell', Robert (Bruce) (1854–1928), American actor, born in Scotland; especially noted for Shakespearean roles ('Hamlet'; 'The Merchant of Venice'; 'King Lear'; 'Richelieu').

Mantinea (*măn-ti-nē'ą*), town in e. Arcadia, ancient Greece: *map* G-197
battle of (362 B.C.), between Thebes and Sparta T-116

Man'tis, or **mantid,** an insect M-81, *pictures* M-81, N-53

Mantis'sa, of logarithm L-296

Mantle, outer fold of tissue that envelops body and lines shell of a mollusk; secreting glands in mantle produce the shell: M-333, 334
nautilus N-69
octopus, cuttlefish, and squid O-339
oyster O-438, *picture* O-436
snail S-203

Mantle, gas G-31

Mantled baboon B-2

Mantua (*mănt'yụ-ą*), Italian **Mantova** (*män'tō-vä*), fortified town in n. Italy, 80 mi. s.w. of Venice; pop. 36,489; home of Vergil; held by French 1797–99, 1801–14, by Austria 1814–66
siege (1796–97) N-8. *See also in Index* Siege, *table*

Man'u, the "Adam" of Hindu mythology; also traditional author of ancient Hindu lawbook.

Manua (*mä-nọ'ä*) **Islands,** group of islands, Tau, Ofu, and Olosega, belonging to American Samoa; acquired 1900; 22 sq. mi.; pop. 2819: *map* P-17

Man'ual, organ O-424

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Manuel (*mä-nọ-ĕl'*) **II** (1889–1932), king of Portugal, 1908 to 1910, when Portugal became a republic
palace, *picture* P-378
Revolution of 1910 L-266

Manuel, Don Juan. *See in Index* Juan Manuel, Don

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Manul (*mä'nụl*), or **Pallas' cat**, a wild cat of Asia; lives in rocky areas from e. border of Caspian Sea to Tibet and Mongolia; about size of domestic cat (head and body 21 in. long, tail 10 in.); fur soft, long, and thick; whitish-gray or light yellowish; black spots on crown, black stripes on rump; preys on small mammals and birds; scientific name *Felis manul.*
Manure, as a fertilizer F-55
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Manzanita (*măn-zȧ-nē'tą*), evergreen shrubs of genus *Arctostaphylos* of the heath family, especially common on Pacific coast of the United States; 3 to 12 ft. high; dark-red, smooth bark; white or pink flowers; red berrylike fruit; several species used in ornamental gardening.
Manzikert, or **Melazkerd,** town in ancient Armenia
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Maple family, or **Aceraceae** (*ăs-ĕr-ā'sē-ē*), a family of trees and shrubs, native chiefly to Northern Hemisphere; includes sugar, or hard, maple, sycamore of England, Norway maple, and box elder.
Maple Heights, Ohio, city 9 mi. s.e. of Cleveland; chiefly residential; pop. 15,586: *map, inset* O-357
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Maracaibo (*mä-rä-kī'bō*), one of chief ports of Venezuela, in n.w. on channel between Gulf of Venezuela and Lake Maracaibo; pop. 232,488; petroleum, coffee, cacao, hides: V-441, *maps* V-442, S-252, *picture* V-443
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Marajó (*mȧ-rạ-zhō'*), or **Joannes** (*zhō-än'nĕs*), island formed by estuaries of Amazon and Pará rivers in n.e. Brazil; area about 18,500 sq. mi.; pop. 124,312: *maps* B-288, S-252
Maranhão (*mȧ-rạ-nyouṅ'*), state on n. coast of Brazil; 133,674 sq. mi.; pop. 1,600,396; cap. São Luís: B-291
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Maratta (*mä-răt'tä*), **Carlo,** or **Maratti** (1625–1713), Italian painter; patronized by five popes; noted for Madonnas, Holy Families; also 'Constantine Destroying the Idols' painted for Lateran baptistery.
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Marburg (*mär'bu̇rḱ*), Germany, town n. of Frankfurt; pop. 39,530; famous for university (founded 1527, first university established without papal privileges); 13th-century church containing tomb of St. Elizabeth of Hungary, and 13th-century castle: *map* E-425
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Marbut, Curtis Fletcher (1863–1935), geologist and soil chemist, born Lawrence County, Mo.; director of Soils Survey, U.S. Department of Agriculture 1910–35: S-229
Marc, Franz (1880–1916), German expressionist painter, born Munich, Germany; animals figure largely in his decorative paintings; killed in battle at Verdun ('Red Horses').
Marcanto'nio, (1488?–1527?), foremost Italian engraver in the Renaissance, first to copy on copper the work of other artists.
Marcasite (*mär'kạ-sīt*), a mineral used as a gem stone; mined in England, Czechoslovakia, France, Mexico, and in Illinois, Missouri, and Wisconsin: J-350, M-262
Marcel'lus, Marcus Claudius (268?–208 B.C.), a Roman general in 2d Punic War, conqueror of Syracuse; five times consul; killed near Venusia.
March, Francis Andrew (1825–1911), philologist, born Millbury, Mass.; professor at Lafayette College 1856–1906 ('Method of Philological Study of the English Language').
March, Peyton Conway (1864–1955), U.S. Army officer, born Easton, Pa., son of Francis Andrew March; commanded Astor Battery, Spanish-American War; member Army general staff 1903–7; artillery commander A.E.F. in France, 1917; made general and chief of army general staff May 1918; retired 1921.
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Marchesi (*mär-kā'zē*), **Mathilde** (née Graumann) (1826–1913), German-French teacher of singing, born Frankfort; married Salvatore Marchesi, Italian baritone; pupils included Melba, Eames, Calvé.
March fly, name for stout-bodied flies (family *Bibionidae*) common in early spring; adults black and red, sometimes yellow; larvae attack roots of grass: F-189
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Marcos de Niza (*mär'kōs dā nē'thä*), Franciscan friar, chosen to explore region of fabled wealth n. of Sonora, Mexico; penetrated to Zuñi, N.M. ("Seven Cities of Cibola"): A-346, N-181
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Marcus Island, triangular island (each side about a mile long) in Pacific 875 mi. n.w. of Wake Island; served as Japanese airfield and radio station in World War II; occupied by U.S. 1945; under Japanese peace treaty with Allies, effective 1952, island was to be administered by U.S. pending the placing of the island under United Nations trusteeship, with U.S. as administering authority: *map* P-16
Marcy, William Learned (1786–1857), statesman, born Southbridge, Mass.; prominent in "Albany Regency"; author of phrase "To the victors belong the spoils"; secretary of state 1853–57.
Marcy, Mount, in n.e. New York, highest peak of Adirondacks and highest point in state (5344 ft.) A-21, *maps* N-196, 205, U-265
Marden, Orison Swett (1850?–1924), author and editor, born Thornton, N.H.; founded and edited *Success Magazine*; ('Pushing to the Front'; 'The Secret of Achievement').
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Mare, an adult female horse H-428
Mare clausum (*mā'rē klô'sŭm*), in international law, sea or portion of sea under jurisdiction of one nation instead of open to all
Bering Sea controversy H-276
Mare (*mâr*) **Island Navy Yard,** in California at e. end of San Pablo Bay, opposite Vallejo; established 1854 by Farragut; builds all classes of naval vessels; repairs cruisers, auxiliaries, and smaller craft.
Maren'go, battle of (1800), fought near village of this name in n. Italy 35 mi. n.w. of Genoa N-8
Marey, Etienne Jules (1830–1904), French physiologist; devised camera for taking a series of pictures in rapid succession (called "photographic gun").
Margaret, Saint (1045?–93), queen of Malcolm III of Scotland and daughter of Edward the Exile of England, son of Edmund Ironside; probably born in Hungary; canonized 1251 because of her benefactions; festival in Roman Catholic church June 10, in Anglican July 20.
Margaret (1353–1412) (Semiramis of the North), queen (governing as regent for nominal sovereigns) of Denmark, Norway, and Sweden
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Margaret, of Anjou (*äṅ-zhō'*) (1430–82), queen of Henry VI of England; died in exile
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Margaret, of Valois (*vȧl-wä'*), or **Angoulême** (*äṅ-gō-lĕm'*) (1492–1549), queen of Henry d'Albret, king of Navarre, and sister of Francis I of France, joint author of the 'Heptameron' stories modeled on the 'Decameron' of Boccaccio; patroness of Marot and other literary men, and protector of Protestants; sometimes called Margaret of Navarre in order to avoid confusion with her grandniece, daughter of Henry II.
Margaret, of Valois (1533–1615), daughter of Henry II of France and Catherine de' Medici, married to Henry of Navarre (afterward Henry IV of France) on eve of Massacre of St. Bartholomew.
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Margarita (*mär-gä-rē'tä*), Venezuelan island in Caribbean Sea; 444 sq. mi.; pop. 69,381; cap. La Asunción; pearl fisheries; discovered by Columbus 1498: *maps* V-442, W-96*a*
Mar'gate, England, popular summer resort on North Sea, 65 mi. e. of London; pop. 42,487: *map* B-325
Margay, a spotted cat resembling the ocelot; found in s. Brazil; about size of large house cat; scientific name *Felis wiedii.*
Marggraf (*märg'gräf*), **Andreas Sigismund** (1709–82), German chemist; discovered sugar in beetroot; valuable observations on phosphoric acid; introduced microscope in chemical investigations: S-445
discovered chemical identity of aluminum A-183
Marghera, Italy, port of Venice V-445
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Marginal land, in agricultural economics, land which yields crops barely equal in market value to the cost of cultivation.
Marguerite (*mär'gē-rēt*), popular name of several flowers of the aster family, such as the China aster, the common garden daisy, and the oxeye daisy; also some cultivated species of chrysanthemum
blue. *See in Index* Felicia
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Margueritte (*mär-gü-rēt'*), **Paul** (1860–1918), and **Victor** (1866–1942), French novelists, brothers, born in Algeria; collaborated in series of novels known under title 'Une Epoque' (1898–1940); after World War I, Victor caused sensation with 'La Garçonne', 'Les Coupables', 'Appel aux Consciences'.
Maria, in Shakespeare's "Twelfth Night', Olivia's pert, clever maid.
Maria II, da Gloria (1819–53), queen of Portugal; succeeded 1827 on abdication of her father, Pedro I; reign troubled by rebellion of her Uncle, Don Miguel, and factional insurrections.
Maria Christina (1858–1929), queen mother of Spain, daughter of Archduke Karl Ferdinand of Austria; left convent, of which she was abbess, to marry Alfonso XII; ruled as queen regent from his death (1885) until Alfonso XIII became of age in 1902.
Mariager (*mä-rē-ȧ-gĕr'*), small seaport of Denmark, in Jutland, 35 mi. n. of Aarhus.
Mariana (*mĕr-ĭ-ăn'ȧ*) **Islands,** also **Marianas,** formerly **Ladrone Islands,** group of 15 islands in Micronesia, Pacific Ocean, 1500 mi. e. of Philippines; 450 sq. mi.; pop. 65,-784; made Japanese mandate 1919 (except Guam, ceded to U.S. 1898); occupied by U. S. 1944; placed under U. S. trusteeship 1947; Saipan is naval base; sugar, copra, bonito fisheries: G-321, *map* P-16
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Marianao (*mä-ryä-nä'ō*), Cuba, resort city about 5 mi. w. of Havana; pop. 229,876, with suburbs: *map* W-96
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Maricopa (*mä-rē-kō'pä*), a Yuman tribe of Indians affiliated with the Pima in s. Arizona.
Marie (1875–1938), queen of Ferdinand I of Rumania; born England, eldest daughter of duke of Edinburgh, second son of Queen Victoria; married Prince Ferdinand, later king, 1893; active in Red Cross work during World War I and in traveling and writing ('The Lily of Life'; 'My Country'; 'Ilderim'); for many years exerted strong influence in Rumanian politics: R-254
Marie Antoinette (*mȧ-rē' än-twŏ-nĕt'*) (1755–93), queen of Louis XVI M-95–6, F-293
burial place P-85
Gluck and G-127
imprisoned in Temple, *picture* F-292
influence on Louis XVI L-320
Petit Trianon at Versailles V-463
Marie Byrd Land, Antarctica, discovered 1929 and named by Richard E. Byrd in honor of his wife A-261, *map* A-259

Marie de France (*mȧ-rē' dŭ fräṅs*), French poetess of 12th century; lived in England, for a time at court of Henry II; wrote narrative poems and fables.

Marie de l'Incarnation (1599–1672), French Roman Catholic nun, born Tours; 1639 went to Canada with Madame de la Peltrie to found Ursuline convent at Quebec; first superior of convent; composed dictionary of French and Algonquian: C-95*a*, C-105

Marie Galante (*ḡȧ-läṅt'*), an island of French West Indies, s.e. of Guadeloupe, of which it is a dependency; 60 sq. mi.; pop. 30,213: *map* W-96*a*

Marie Louise (1791–1847), 2d wife of Napoleon I; daughter of Emperor Francis I of Austria: N-9, 11, *picture* N-9

Marienbad (*mä-rē'ĕn-bät*), Czech **Marianske Lasne** (*mär'yȧn-skä läz'nyĕ*), in Czechoslovakia, celebrated watering place near w. border of Bohemia; pop. 6027; mineral springs.

Marienburg (*mä-rē'ĕn-bụrκ*), or **Malbork** (*mäl'bôrk*), Poland, former German (East Prussian) city on Nogat River 30 mi. s.e. of Danzig; included in Poland since 1945; pop. 10,017; machinery, cotton, and lumber manufactures; old castle, founded in 13th century, seat of Teutonic Knights (1309–1457); historic 14th-century town hall: *map* E-424

Marie Thérèse Charlotte, daughter of Louis XVI, *picture* F-292

Mariet'ta, Ga., city 17 mi. n.w. of Atlanta; pop. 20,687; Kennesaw Mountain National Battlefield Park nearby: *map* G-76

Marietta, Ohio, on Ohio and Muskingum rivers; pop. 16,006; large river trade; furniture, paints, steel safes, concrete products; truck gardening, sandstone quarrying, and cattle raising; Marietta College; named for Marie Antoinette: *map* O-357
- earliest historical pageant P-19*a*
- first settlement in state O-362

Marietta College, at Marietta, Ohio; founded 1797 as an academy college charter 1835; arts and sciences, business administration, petroleum engineering.

Marignac (*mȧ'rē'nyȧk'*), **Jean Charles de** (1817–94), Swiss chemist, discoverer of ytterbium and gadolinium.

Marignano (*mä-rēn-yä'nō*), Italy, also **Melegnano**, town in n. Italy 10 mi. s.e. of Milan; scene of victory of Francis I of France over Swiss allies of Milan (1515).

Mar'igold, a plant of the aster family M-96, *picture* M-96
- marsh M-103
- Tetra P-307

Marigold, fig. *See in Index* Fig marigold

Marihuana (*măr-ĭ-wä'nạ*), or **hashish**, a narcotic drug H-333, N-13

Marihuana Tax Act N-13

Marim'ba, a musical instrument
- African, *picture* M-459
- Latin American, *picture* L-117

Marin (*mȧ'rin*), **John** (1872–1953), painter, born Rutherford, N.J.; distinguished water colorist; favorite subjects New York City's skyscrapers, boats, and scenes in Maine; faultless composition, simplicity in form and pattern, fluid and radiant color: P-35, 37*a*
- 'Maine Islands' P-35, 37*a*, *color picture* P-37

Marina, Cortez' interpreter C-488

Marina Fall, British Guiana, on the Ipobe River; 500 ft. high; discovered 1934.

Marine Band. *See in Index* United States Marine Band

Marine barometer, or **Kew barometer** B-59

Marine charts N-74, 76
- compass rose, *pictures* N-75, 79

Marine climate, or **ocean climate** C-349, O-332, 335–6, E-422, 429

Marine Corps, British M-97*a–b*

Marine Corps, United States. *See in Index* United States Marine Corps

Marine engineering, defined E-345

Marine gar, fish G-11

Marine insurance I-168*a–b*, 170

Marineland, Fla., 17 mi. s. of St. Augustine, on Atlantic Ocean, *map* F-158
- Marine Studios A-281, P-375, *picture* A-281

Marineland of the Pacific, an oceanarium near Los Angeles, Calif. A-281

Marine life O-330, 332, B-150, *pictures* O-329, 331
- glass models, *color picture* G-124
- oceanarium A-281, *picture* A-281

Marine Parkway Bridge, New York City. *See in Index* Bridge, *table*

Marmera (*mä-rē-na'rä*), a dance L-116

Mariner's compass. *See in Index* Compass

Mariners' measure, *table* W-87

'Marines' Hymn' M-97*b*

Marinette (*mar-ĭ-nĕt'*), Wis., shipping port on Green Bay at mouth of Menominee River; pop. 14,178; knit goods, lumber products, paper, cutlery; fishing: *map* W-172

Marinetti (*mär-ē-nĕt'tē*), **Filippo Tommaso** (1878–1944), Italian poet, playwright, and essayist; leader of Futurist movement in literature and painting in Italy.

Marini (*mä-rē'nē*), **Giovanni Battista** (1569–1625), Italian poet; style stilted and ornate ('L'Adone').

Marinus (*mä-rē'nụs*), **Saint**, legendary founder of republic of San Marino.

Marion, Francis (1732?–95), American Revolutionary War soldier M-97*b*–8, *picture* M-97*b*

Marion, Ill., city 52 mi. n.e. of Cairo; pop. 10,459; fruit farming; coal; Southern Illinois Veterans' Hospital: *map* I-37

Marion, Ind., manufacturing town 60 mi. n.e. of Indianapolis; pop. 30,081; auto trucks, paper products, glass, foundry products, machinery; Marion College: *maps* I-78, U-253

Marion, Ohio, industrial city 46 mi. n. of Columbus in agricultural district; pop. 33,817; steam shovels, tractors, automobile parts, glass: *maps* O-356, U-253

Marionettes P-440, 441. *See also in Index* Puppets and marionettes
- books about making H-401

Mariotte (*mȧ-rē-ôt'*), **Edmé** (1620?–84), French physicist; independent discoverer of law usually called Boyle's law
- Boyle's law G-28, *picture* G-29

Mariposa, fish. *See in Index* Moonfish

Maripo'sa Grove, Calif., a grove of sequoia trees, part of Yosemite National Park S-102

Mariposa lily. *See in Index* Sego lily

Maris, Jacob (*1837–99*), Dutch painter, born at The Hague; distinguished for his luminous yet misty paintings of Holland landscapes. His brothers, **Matthew** (1839–1917) and **William** (1843–1910), who moved to London, were also artists of note.

Maritain (*mȧ-rē-tăṅ'*), **Jacques** (born 1882), French philosopher, Roman Catholic convert 1906; made professor at Institute Catholique, Paris, 1913, at Institute of Mediaeval Studies, Toronto, Ont., 1940; French ambassador to Vatican 1945–48; professor at Princeton University, N.J., 1948–52 ('Art and Scholasticism'; 'Science and Wisdom'): E-254

Maritime Administration, U. S. U-367, S-161

Maritime Alps, *map* I-262

Maritime Andes, or **Caribbean Hills**, Venezuela V-441

Maritime Board, Federal, U.S. U-367

Maritime Commission, United States R-205, S-161

Maritime Day F-56

Maritime Labor Board (MLB) R-205

Maritime Provinces, Canada C-67, 75
- agriculture C-85
- occupations, *pictograph* C-66

Maritsa (*mä-rē'tsä*) **River**, in Balkan Peninsula; flows about 300 mi. into Aegean Sea: *maps* D-16, B-23, G-189

Marius (*mȧ-rē-ŭs'*), lover of Cosette in 'Les Misérables' H-442

Marius, Gaius (155?–86 B.C.), Roman general R-186
- Pompey opposes P-368

Marivaux (*mȧ-rē-vō'*), **Pierre Carlet de Chamblain de** (1688–1763), French writer; had great influence on development of French comedy and novel; his clever, often affected, style became known as *marivaudage* ('Les fausses Confidences', 'Le Legs', plays; 'Marianne', an unfinished but important novel).

Mar'joram, an herb of the mint family S-340, 341
- as a dye S-339

Marjoram, sweet, a perennial herb (*Majorana hortensis*) of the mint family, native to Europe; grows to 2 ft.; leaves oval, grayish-green; flowers, purple or white, in oblong spikes; used in medicine, and leaves used as a seasoning in foods; usually grown as an annual plant because easily killed by cold: S-340

Mark, Saint, traditional author of the Second Gospel; festival April 25: A-275
- Dürer portrays, *color picture* P-27*b*

Mark, Gospel of Saint A-275

Mark, the monetary unit of Germany from 1873 to 1924; replaced by reichsmark of same nominal value, 23.8 cents; later nominally worth about 24 cents. During occupation of Germany after World War II, several paper currencies with the name "mark" were used; values fluctuated with political changes. Also an Anglo-Saxon money of account ($3.23) and an old Scottish coin (27 cents).

Mark Antony. *See in Index* Antony, Mark

Mar'ken, Netherlands, village formerly on island before draining of Zuider Zee; people generally wear national costumes: *map* B-111

Market, an assembly place for the exchange or sale of goods or securities; also the general demand for goods of any particular type. *See also in Index* Fairs and expositions; Marketing
- American Colonies A-205
- boards of trade B-213–14, *pictures* B-213
- Bolivia B-223, *picture* B-223
- Brazil, *picture* B-298
- Bruges' Market Hall, *picture* B-333
- Chicago: Board of Trade E-227–8; Maxwell Street, *picture* C-234; stockyards M-153, 156, *pictures* C-235, M-153–5; wholesale fruit and vegetable, *picture* C-235
- commodity exchanges E-227–8
- Cracow, Poland C-505
- Damascus bazaar D-12

Greece, roadside, *picture* G-192
Guatemala G-222*a*, *picture* G-222
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Peking bazaar P 112
Tunisia, *picture* T-207

Market gardening. *See in Index* Truck farming

Marketing, the process of distributing and selling goods and services E-227–8. *See also in Index* Market; Trade, Transportation
advertising helps A-23–4
agricultural A-66–70, *pictures* B-213: Canadian Wheat Board C-86; commodity exchanges B-213–14, E-227–8; federal agencies F-20, H-422, U-365, A-69; Yucatán, Mexico, henequen Y-345
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stock exchanges E-226
surplus crops, government control A-68–9

Marketing agreement, M-360

Market price, of stocks S-398*b*

Mark'ham, Sir Clements (1830–1916), English geographer for more than 60 years an active explorer and supporter of explorations by others funds for Scott's South Polar voyage raised almost entirely by his efforts ('The Lands of Silence', history of polar explorations)

Markham, Edwin (1852–1940) poet born Oregon City, Ore herded cattle and sheep on a California ranch in youth, school principal until 1899, when he turned entire attention to writing and lecturing ('The Man with the Hoe and Other Poems', 'Lincoln, and Other Poems', 'The Gates of Paradise'; 'The Ballad of the Gallows Bird', 'The Children in Bondage', a book on child labor)

Markham, William (1635?–1704), English colonial governor, cousin of William Penn, not a Quaker himself although he led first band of Quakers to Pennsylvania, preceding William Penn P-138

Markham, Mount, Antarctica on w edge of Ross Shelf Ice, discovered by Robert F Scott 1902, highest known mountain in Antarctica, 15,102 ft · *map* A-259
height comparative *See in Index* Mountains, *table*

Mar'khor ("snake-eater"), large wild goat (*Capra falconeri*) of the Himalayas with spirally twisted horns and long, shaggy coat

Mark'ka, monetary unit of Finland, historical value about 2½ cents at one time coined with a value of 19 3 cents

Markland, name given by Norse to a wooded place between Greenland and Vinland E-391

Markoe, Abraham (1729–1806), Danish merchant of Philadelphia, born in Danish West Indies (Virgin Islands), formed troop to fight in Revolutionary War

Markova, Alicia, real name Lilian Alice Marks (born 1910), English ballerina, born London, Eng and, with Diaghilev Ballet 1925–29, later with Vic-Wells Ballet, London, Markova-Dolin Ballet, Ballet Russe de Monte Carlo, Ballet Theater *picture* B-28

Mark Twain. *See in Index* Twain, Mark

Marl, impure limestone M-262

Marlborough (*môl'bŭ-rŭ*), **John Churchill, first duke of** (1650–1722), English general and statesman M-98, A-253
Swift attacks S-469

Marlborough, Sarah Jennings Churchill, duchess of (1660–1744), favorite of Queen Anne M-98

Marlborough (*marl'bûr-ō*), Mass, city 28 mi w of Boston, pop 15,-756, boots and shoes, nearly destroyed by Indians in King Philip's War (1676) *map* M-133

Marlborough (*mol'bu-rŭ*) **House,** London, built by Sir Christopher Wren for the first duke of Marlborough L-304

Marlin, Tex, health resort 25 mi s e of Waco, pop 7099, mineral water wells, famous baths, sanatoriums, clinics, manufacture of mineral crystals *map* T-90

Marlin, any of several salt-water fish related to sailfish and spearfish, family *Istiophoridae*, genus *Makaira*, deep-water game fish of Hawaii, Japan California, Mexico, West Indies and Florida north to Cape Cod, often taken with harpoon weight of F-100

Marline. *See in Index* Nautical terms, *table*

Marlinespike. *See in Index* Nautical terms *table*

Marlowe (*mar'lō*), **Christopher** (1564–93), great English poet and dramatist, "father of English tragedy" and of English blank verse, "most daring and inspired pioneer in all our poetic literature" ('Tamburlaine 'Doctor Faustus', 'The Jew of Malta') E-376*b*
basis of 'Tamburlaine' M-346
influence on Shakespeare S-126, 130

Marlowe, Julia (1866–1950), American Shakespearean actress born England, starred with Edward Hugh Sothern, whom she married, retired 1924 *picture* D-134

Mar'mara, Sea of, also **Marmora,** ancient Propontis sea between European and Asiatic Turkey *maps* T-215, E-417, B-204 *See also in Index* Ocean *table*

'Marmion: a Tale of Flodden Field', poem by Sir Walter Scott telling of the adventures and futile love for Lady Clare of Lord Marmion, leader of the Scots, who was finally slain at Flodden Field, contains the ballad of 'Young Lochinvar'. S-67

Marmol (*mar'môl*), **José** (1818–71), Argentine novelist L-125

Marmolada (*mar-mō-la'da*), highest peak of the Dolomites (10 972 ft).

Marmora, Sea of. *See in Index* Marmara Sea of

Mar'moset, a small South American monkey of *Hapalidae* family M-350, *picture* M-349

Mar'mot, a genus of rodents belonging to the ground squirrel group ground hog G-219
hibernation H-353

Marne (*marn,* French *marn*) **River,** in n e France, scene of two decisive battles of World War I and of severe fighting in World War II M-98–9, *maps* F-259, E-425. *See also in Index* Château-Thierry
first battle (1914) M-98, W-220· Foch F-191, Joffre J-357
second battle (1918) M-98–9, W-230

Mar'onites, a Christian sect of Syria S-488

Maronobu (*ma'rō'nō'bq'*) (1625–94), Japanese painter, noted chiefly for skillful and powerful paintings of actors and beautiful women, first Japanese painter to make designs for wood-block prints

Marot (*ma-rō*) **Clément** (1495?–1544), French poet, introduced new grace and ease into stiff forms of French poetry (translation of Psalms, 'L'Adolescence', 'Clémentine' 'Blasons')

Marpessa (*mar-pĕs'ą*), in Greek mythology, a maiden who was loved by Apollo but preferred her human lover Idas

Marquand, John Phillips (born 1893), novelist, born Wilmington, Del, travels in China form the background of 'Ming Yellow' and the Mr Moto stories, 'The Late George Apley' Pulitzer prize novel (1938), 'Wickford Point' 'So Little Time', 'Point of No Return' and 'Melville Goodwin, U S A', are penetrating satires and social analyses

Marque (*mark*) **letters of** P-272

Marquesas (*mar-kā'sas*) **Islands,** French **Iles Marquises** (*ēl mar-kēz'*), group of 11 Polynesian volcanic islands in French Settlements in Oceania, s Pacific Ocean, about 3300 mi s w. of Los Angeles Calif, 480 sq mi, pop 2976 *map* P-17

Marquess. *See in Index* Marquis

Marqueste (*mar-kĕt'*), **Laurent Honoré** (1848–1920) French sculptor, statue of Victor Hugo in Sorbonne, classical works include his famous 'Cupid'

Marquetry, or **inlaying**
furniture decoration I-178, 179

Marquette (*mar-kĕt'*), **Jacques** (1637–75), French Jesuit missionary and explorer M-99, *picture* M-99
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founds Sault Ste Marie, Mich S-51
Illinois River I-27
Joliet assists J-362, M-99, *map* U-378
Statuary Hall *See in Index* Statuary Hall (Wisconsin), *table*

Marquette, Mich, summer resort manufacturing and shipping center on Lake Superior, pop 17,202, large steel and concrete ore docks mining lumbering commercial fishing, railroad shops Northern Michigan College of Education· *maps* M-226, U-253

Marquette University, at Milwaukee Wis, Roman Catholic founded 1864, organized as a college 1881 as a university 1907, colleges of liberal arts, business administration, dentistry, engineering, journalism law, medicine, nursing speech, graduate school

Marquis (*mar'kwis*), **Don** (Donald Robert Perry) (1878–1937), writer of stories plays and verse, born Walnut, Ill; columnist *New York Evening Sun,* won wide audience for his humorous bits of wisdom ('The Old Soak', 'Archy and Mehitabel'; 'Off the Arm')

Marquis (*mar'kwis* or *mar-kē'*), also **marquess,** European noble next in rank below a duke, wife is called marquise (*mar-kēz'*) or marchioness (*mar'shŭn-ĕs*) D-42

Marquise (*mar-kez'*) **cut,** in diamond cutting, *pictures* D-79, J-350

Marquisette (*mär-ki-zĕt'*), fabric of open, loose weave, of cotton, silk, rayon, wool; used for curtains.
Marquis of Queensberry rules, for boxing B-267, 270
Marquis wheat W-116
Marrakech (*mạ-rä'kĕsh*), also **Marrakesh,** formerly **Morocco City,** French Morocco, one of the chief cities of Morocco; pop. 215,312; morocco leather manufactures; founded 1072; most prosperous about 1300, when population is said to have been approximately 700,000: *maps* A-167, A-46, *color picture* A-38
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American Indians I-108*d*
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goddess of, Hera, or Juno H-341, J-365
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polygamy. *See in Index* Polygamy
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Marriage, goddess of (Hera, or Juno) H-341, J-365
'Marriage à la Mode,' paintings by Hogarth, *picture* H-405
Marriage counselor M-101*b*
'Marriage of Figaro', opera by Mozart O-391
Marriott, (Joyce) Ann (Mrs. Gerald J. McLellan) (born 1913), Canadian poet, born Victoria, B.C. ('Calling Adventurers'; 'Sandstone, and Other Poems').
Marrow, of bones B-226, 227
blood cells made by B-208, *diagram* B-209
Marryat (*măr'i-ăt*), **Frederick** (1792–1848), English naval captain and novelist; own experiences formed background of his many famous sea stories ('Mr. Midshipman Easy'; 'Peter Simple'; 'Snarley-yow, or the Dog Fiend'; 'Masterman Ready' and other boys' stories).
Mars, Roman god of war, identified with Greek Ares M-102, A-446
Aphrodite and A-273
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Mars, a planet P-282, 283–4, *diagrams* P-282–3, *pictures* M-102, P-284, *table* P-283
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Marsala, Sicily, ancient Lilybaeum. *See in Index* Lilybaeum
'Marseillaise, La' (*lȧ mär-sĕ-yĕz'*), French national song N-40, M-102
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Marseilles (*mär-sālz'*), French Marseille (*mär-sĕ'yü*), seaport on Mediterranean; 2d city of France; pop. 551,640: M-102, *maps* F-259, E-416, 425
early trade center T-165
harbor M-102, *picture* H-263
soap S-211
Marsh, George Perkins (1801–82), diplomat, lawyer, and philologist, born Woodstock, Vt.; member U. S. House of Representatives; U.S. minister to Turkey and to Italy ('Lectures on the English Language').
Marsh, Grant Prince (1834–1916), steamboat captain, pioneer pilot of the upper Missouri, born Chautauqua County, N.Y.; began career as cabin boy at age of 12; rendered invaluable assistance to armies of Sully, Forsyth, Custer, Terry, and Reno in wars with the Sioux (1864–76).
Marsh, Othniel Charles (1831–99), paleontologist, born Lockport, N.Y.; professor at Yale University from 1866; discovered many vertebrate fossils in w. United States; vertebrate paleontologist, U.S. Geological Survey from 1882; greatly improved the methods of preparing vertebrate fossils for exhibition.
Marsh, Reginald (1898–1954), American painter, born Paris, France; noted for portrayal of New York City life—theater, crowded subways, beaches, Bowery scenes; painted murals for United States Post Office Building, Washington, D. C.
Marsh, a tract of low, wet land. *See in Index* Swamp
Marshal, title derived from ancient title of masters of horse of Frankish kings; highest military officer in France called "marshal" since 13th century; German Feldmarschall and English Field Marshal derived from it; in United States, ministerial officer of federal courts; also, in certain sections, the town or village policeman.
Marshall, Archibald (1866–1934), English novelist; pictured the English country gentleman and his family ('The Eldest Son'; 'The Old Order Changeth'; 'The Hall and the Grange').
Marshall, Charles (1887–1951), operatic tenor, born Auburn, Me.; with Chicago Opera Association and its successor, Chicago Civic Opera Company, 1920–32; retired 1932; leading roles in 'Otello', 'Aïda', 'Pagliacci', 'William Tell'.
Marshall, George Catlett (born 1880), U.S. Army officer: M-102–3, *pictures* M-102, W-255, 271
plan for European reconstruction (1947) T-198, U-394
Marshall, James Wilson (1810–85), pioneer, born Hunterdon County, N.J.; started on Oregon Trail 1844; took part in Bear Flag Revolt 1846
discovered gold in California S-2
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Marshall, John (1755–1835), chief justice U.S. Supreme Court M-103, *picture* M-103
Hall of Fame, *table* H-249
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Marshall, Sir John Hubert (born 1876), English archaeologist, born Chester, England; director general of archaeology in India 1902–31: I-128
Marshall, Thomas Riley (1854–1925), statesman, born North Manchester, Ind.; governor of Indiana 1909–13 ('Recollections; a Hoosier Salad')
vice-president of U.S. *See in Index* Vice-president, *table*
Marshall, Tex., industrial city 37 mi. w. of Shreveport, La.; cotton, fruit, vegetable, and livestock interests; pop. 22,327; railroad shops, lumber, car wheels, brick, pottery; natural gas, iron ore, silica sand, clay nearby; Bishop and Wiley colleges (Negro); *maps* T-90, U-253
Marshall College, at Huntington, W. Va.; state control; founded 1837; arts and sciences, education; graduate school.
Marshall Ford Dam, in Texas, on Colorado River. *See in Index* Dam, *table*
Marshall Islands, archipelago made up of Ralik group (11 main islands) and Ratak group (13 main islands) in Micronesia, Pacific Ocean, e. of Caroline Islands and n. of Gilbert Islands; about 160 sq. mi.; pop. 11,033; came under German rule 1885; made Japanese mandate 1919; occupied by U. S. 1944; placed under U. S. trusteeship 1947; Jaluit was Japanese naval base; chief export copra: *map* P-16
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Marshall Plan, for European reconstruction (1947) T-198, U-394
Marshalltown, Iowa, industrial city 55 mi. n.e. of Des Moines in agricultural and stock-raising district; pop. 19,821; corn-canning plants; railroad shops; gray iron and brass work, furnaces; Iowa State Soldiers' Home: I-220, *maps* I-215, U-253
Marsh deer, in South America D-44
Marshfield, Wis., city near center in dairy region; pop. 12,394; lumber, box and shoe factories; St. Joseph's Hospital, Wood County Hospital, School for Deaf: *map* W-173
Marsh gas. *See in Index* Methane
Marsh hawk H-292, 293
quail and B-191
Marsh mallow, a plant (*Althaea officinalis*) of the mallow family having large, heart-shaped, velvety leaves and clusters of pale rose-colored flowers; roots used for mucilage and in medicine; occasionally the whole plant is eaten.
Marshmallow, a sweetmeat C-112
Marsh marigold, plant of buttercup family M-103
Marsh rabbit R-16, 19
Marsh shrew, or water shrew S-168
foot, *picture* F-225
Marsh tortoise T-158
Mars-la-Tour (*mär-lȧ-tor'*), village in n.e. France, 15 mi. w. of Metz; battle (also called Vionville) in Franco-German War (1870) when German brigade was destroyed.
Marston, John (1575?–1634), English dramatist, born of Italian mother, probably at Coventry, England (comedies: 'Eastward Hoe', with George Chapman and Ben Jonson, and 'The Dutch Courtezan'; tragicomedy: 'The Malcontent', with additions by John Webster).
Marston Moor, plain in Yorkshire, England, 8 mi. from York
battle of (1644) C-516, C-191
Marsupia'lia, the order of mammals comprising the marsupials, *Reference-Outline* Z-364
Marsupial mole, a burrowing animal of the family *Notoryctidae*, found in central and n.w. Australia; about 6 in. in length; blind, as eyes are beneath skin; lives on insects.
Marsu'pials, mammals such as kangaroo, with abdominal pouch for carrying young M-62
America: opossum O-399
Australia A-479–80: kangaroo K-1–2, *pictures* K-1–2
cuscus K-2, *color picture* P-6
evolutionary scale K-2
New Guinea N-141
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Tasmania T-22, *picture* T-21
Marsyas (*mär'si-ȧs*), satyr in Greek mythology A-274
Martaban (*mär-tȧ-bän'*), **Gulf of,** on coast of lower Burma, inlet of Bay of Bengal, *map* A-407
Martel, Charles. *See in Index* Charles Martel
Marten, an animal of the weasel family M-104, *picture* M-104
altitude range of pine marten, *picture* Z-362

Martha, sister of Lazarus and Mary, and friend of Jesus (Luke x, 38), commemorated as saint July 29.
'Martha', opera by Friedrich von Flotow
story O-391
Martha's Vineyard, summer resort island off s.e. coast of Massachusetts; 23 mi. long: *maps* M-124, 133, U-253
Martí (*mär-tē'*), José Julián (1853–95), patriot and author, born Havana, Cuba; twice imprisoned and deported to Spain for his liberal ideas and writings; escaped to Mexico and U. S., where he wrote propaganda for Cuban independence; 1895 joined Máximo Gómez in revolutionary movement and was killed in battle with Spaniards.
Martial (*mär'shal*), anglicized name of Marcus Valerius Martialis (A.D. 40?–104?), greatest Roman epigrammatist L-131
Martial law L-140, C-500
reconstruction period following American Civil War R-85*b*
Martin, Saint (316–400), bishop of Tours, born in Hungary; a patron saint of France and of cities of Mainz, Würzburg, and Buenos Aires; feast day November 11; founded monastery of Ligugé near Poitiers, France, in 360
Martinmas festival F-59
Martin, popes. For list, *see in Index* Pope, *table*
Martin, Abraham (1589–1664), Canadian settler, born Scotland; emigrated to Canada 1614; member of Company of New France, he received grant of land on heights of Quebec later known as Plains of Abraham.
Martin, A(rcher) J(ohn) P(orter) (born 1910), English biochemist, born London, England; shared 1952 Nobel prize for chemistry with R.L.M. Synge for researches on chromatography, facilitating the separation of closely related compounds.
Martin, Everett Dean (1880–1941), writer and lecturer on social philosophy and psychology, born Jacksonville, Ill.; formerly Congregational minister; director of Peoples Institute and of Cooper Union Forum, New York; professor of social philosophy, Claremont Colleges, California, after 1936; did much to popularize study of psychology ('Psychology'; 'Meaning of a Liberal Education').
Martin, Felix (1804–86), French Jesuit priest, historian, born Auray, France; helped to reestablish Jesuit order in Canada 1842–62; designed St. Patrick's church, Montreal; biographer of French explorers and missionaries; editor of 'Jesuit Relations'.
Martin, Glenn L. (born 1886), airplane manufacturer, born Macksburg, Iowa; started building and flying airplanes 1907; founded Glenn L. Martin Co. to manufacture airplanes 1911.
Martin, Gregory (died 1582), English scholar, translator of Douay, or Douai, version of Bible B-135
Martin, Helen Reimensnyder (1868–1939), novelist and short-story writer, born Lancaster, Pa.; graphic stories of Pennsylvania Dutch life ('Tillie, a Mennonite Maid' and 'Barnabetta', both dramatized; 'For a Mess of Pottage').
Martin, Homer (1836–97), landscape painter, born Albany, N. Y.; influenced first by American Hudson River School, later by French Barbizon painters.
Martin, Joseph W(illiam), Jr. (born 1884), political leader and newspaper publisher, born North Attleboro, Mass.; served in Massachusetts state legislature 1912–14, in state senate 1914–17; U.S. representative from Massachusetts since 1925; permanent chairman Republican national convention 1940, 1944, 1948, and 1952; Republican minority leader House of Representatives 1939–47, 1949–53, speaker 1947–49 and 1953–.
Martin, Josiah (1737–86), governor of North Carolina colony N-279
Martin, Luther (1748?–1826), lawyer and political leader, born near New Brunswick, N.J.; delegate to the Constitutional Convention at Philadelphia in 1787, but opposed strong central government and did not sign the Constitution; first attorney general of Maryland and served 1778–1805 and 1818–22; defended Aaron Burr in trial for treason (1807).
Martin, Richard (1754–1834), English instigator of anticruelty laws H-443
Martin, purple. *See in Index* Purple martin
Martin du Gard, Roger (born 1881), French author; Nobel prize (1937) for his novel-cycle, 'Les Thibaults', which portrays history of a French family in decade before World War I; earlier novel 'Jean Barois'.
Martineau (*mär'ti-nō*), Harriet (1802–76), English writer; popularized theological speculation of her day; from a Unitarian became an agnostic ('Eastern Life, Present and Past'; 'Illustrations of Political Economy'; 'Society in America').
Martineau, James (1805–1900), English philosopher and Unitarian divine, brother of Harriet Martineau; great influence as preacher in Liverpool and London; professor mental and moral philosophy at Manchester New College ('Endeavors after the Christian Life'; 'Types of Ethical Theory').
Martinelli (*mär-tē-nĕl'lē*), Giovanni (born 1885), Italian dramatic tenor; with Metropolitan Opera Company, New York City.
Martinez (*mär-tēn'āth*), Peter (1523–65), Spanish Jesuit missionary, born Aragon, Spain; accompanied Spanish expedition to Florida in 1565; said to be first Jesuit to reach North America; killed by Indians.
Martinez Ruiz, José. *See in Index* Ruiz, José Martinez
Martínez Sierra (*sē-yĕr'ä*), Gregorio (1881–1947), Spanish dramatist and novelist, collaborated with his wife, Maria de la Lejarraga (born 1880); helped replace old melodramas of Spanish stage with plays of delicacy ('The Cradle Song'; 'The Kingdom of God').
Martin Falls, in Upper Coulee, Washington, *picture* C-415*a*
Martini (*mär-tē'nē*), Giovanni Battista (1706–84), Italian musician; teacher of composition, writer on musical theory; composed sacred music.
Martini, Simone (*sē-mō'nä*) (1285?–1344), Italian painter of Sienese school, pupil of Duccio; works highly decorative, influenced by Byzantine tradition; his exquisite surfaces, beautiful color, and sinuous line evident in subsequent Sienese painting; best known for frescoes for churches of Assisi, Siena, Naples, and Orvieto.
Martinique (*mär-t'n-ēk'*), island of West Indies; French overseas department; 385 sq. mi.; pop. 261,595: M-104, *maps* W-96*a*, N-251
people, *picture* W-95
Saint Pierre and Mont Pelée M-104
Martinmas, a holiday F-59
Martinsburg, W. Va., industrial city 55 mi. n.w. of Washington, D.C.; pop. 15,621; limestone, clay, shale nearby; ships apples; hosiery, woolen goods, brick, cement, flour, apple products; strategic point in Civil War: *map* W-107
Martins Ferry, Ohio, industrial city on Ohio River almost opposite Wheeling, W. Va.; pop. 13,220; in agricultural, coal, and limestone region; iron and steel products; birthplace of W. D. Howells: *map* O-356
Martinsville, Va., city 40 mi. s. of Roanoke; pop. 17,251; furniture plants, knitting and hosiery mills: *map* V-486
Martinu (*mär'tin-ọ*), Bohuslav (born 1890), composer, born Czechoslovakia; came to U. S. 1941; Czech element with French influence in compositions which include chamber music, concertos, operas, symphonies.
Martin Vaz Rocks, group of three barren islets in South Atlantic Ocean A-451
Martiny, Philip (1858–1927), American sculptor, born Alsace-Lorraine; did much to refine decorative sculpture in America; works include the sculpture for the grand staircase of the Congressional Library, Washington, D. C.; Soldiers and Sailors Monument, Jersey City, N. J.
Martynia, a plant. *See in Index* Unicorn plant
Martynia (*mär-tin'i-ạ*) family, or Martyniaceae (*mär-tin-i-ā'sē-ē*), a family of plants, native to the tropical regions, including proboscis flower, or unicorn plant, and South American vegetable escorzonera.
Martyrs M-104
apostles A-275
Bunyan under Charles II B-354–5
English, under Mary I M-105
Marvel, Ik, pen name of Donald G. Mitchell (1822–1908), author, born Norwich, Conn.; contributed to leading American magazines from 1842 to 1897 ('Reveries of a Bachelor'; 'Dream Life').
Marvell, Andrew (1621–78), English poet and satirist; assistant to Milton as Latin secretary under Cromwell; under Restoration attacked Charles II and advocated a republic; remembered now for his lyrics: E-378
quoted C-191, E-378
Marvel of Peru. *See in Index* Four-o'clock
'Marvels of the World, The' ('Les Merveilles du monde'), a book of the Middle Ages B-232, *color picture* B-233
Marvin, Charles Frederick (1858–1943), meteorologist, born Putnam, Ohio; chief, U.S. Weather Bureau 1913–34; invented a sunshine recorder and other weather instruments.
Marwar, in India. *See in Index* Jodhpur
Marx (*märks*), Karl (1818–83), German socialist, founder and leader of Marxian socialism M-105, S-216, *picture* S-216
Communist manifesto C-425–6
quoted on religion R-272
Marx, Wilhelm (1863–1946), German political leader; entered Reichstag 1910; a leader of Center party, of which he became president 1921; chancellor of Reich 1923–24 and 1926–28.
Mary, mother of Jesus J-339–40, M-24–5. *See also in Index* Madonna
Mary, sister of Martha and Lazarus

(Luke x, 38–42; John xi, 1–46, and xii, 1–9); sometimes identified with St. Mary Magdalene.
Mary (1867–1953), queen of George V of England; daughter of Francis, duke of Teck: G-67, 68, *pictures* G-68, E-334*a*
Mary I (1516–58), queen of England M-105–6
Elizabeth I imprisoned by E-332
Lady Jane Grey and G-215
Mary II (1662–94), queen of England; joint ruler with William III M-106, W-138–9. *See also in Index* William III
Mary (1542–87), queen of Scots, or **Mary Stuart** M-106–7, S-65, *picture* M-107
Edinburgh associations E-234
Elizabeth I and E-333, M-106–7
Knox and K-63
Scott's portrait of S-69
watch owned by W-57
Mary (1457–82), duchess of Burgundy, daughter of Charles the Bold; compelled to restore to her Dutch subjects rights lost under her ancestors, thus paving way for Dutch independence
loses French possessions C-196
tomb at Bruges B-332
Mary, Russia. *See in Index* Merv
Mary Baldwin College, at Staunton, Va.; Presbyterian; for women; founded 1842; arts and sciences.
Marycrest College. *See in Index* St. Ambrose College and Marycrest College
Maryes' Height, low ridge behind Fredericksburg, Va.; position held by Confederates in battle of Fredericksburg
Hancock's attack on H-255
Marygrove College, at Detroit, Mich.; Roman Catholic; for women; founded 1910; arts and sciences.
"Mary had a little lamb." *See in Index* 'Mary's Lamb'
Mary Hardin-Baylor College, at Belton, Tex.; Baptist; for women; chartered 1845; arts and sciences, Bible and social science, biological and social sciences, language and literature, music.
Maryland, a middle Atlantic state of U.S.; 10,577 sq. mi.; pop. 2,343,001; cap. Annapolis: M-108–22, *maps* M-116–17, 110, 113, U-253, 265, 275, *pictures* M-108–9, 119–21
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song, state M-111
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tree, state M-111
'Maryland, My Maryland', song N-41
Maryland, University of, at College Park, Md.; state control; founded 1807; arts and sciences, agriculture, commerce, education, home economics, military science, physical education, special and continuation studies; graduate school; schools of dentistry, law, medicine, nursing, pharmacy at Baltimore: *picture* M-121
Maryland Day (March 25) F-56
Maryland yellowthroat, warbler W-7. *See also in Index* Yellowthroat
Marylhurst College, at Marylhurst, Ore.; Roman Catholic; for women; founded 1930; arts and sciences, music.
Mary Magdalene ("Mary of Magdala"), convert and devoted follower of Jesus (John xx); commemorated as saint July 22: J-340
Mary Manse College, at Toledo, Ohio; Roman Catholic; for women; founded 1873 as Ursuline Convent of the Sacred Heart; became college 1922; arts and sciences.
Marymount College, at Salina, Kan.; Roman Catholic; for women; founded 1922; arts and sciences.
Marymount College, at Tarrytown, N. Y., with branch in New York City; Roman Catholic; for women; founded 1907; arts and sciences.
Mary of Guise (*gēz*), or **Mary of Lorraine** (1515–60), queen of James V of Scotland, later regent for her daughter, Mary, queen of Scots; arranged French alliance; used Scotland to aggrandize Guise family; opposed Protestant movement.
'Mary's Lamb', familiar jingle by Sarah J. Hale, published 1830 in *Juvenile Miscellany*, an American children's magazine; commonly known by first line, "Mary had a little lamb."
Mary Stuart. *See in Index* Mary, queen of Scots
Maryville College, at Maryville, Tenn.; Presbyterian; founded 1819; arts and sciences, home economics.
Mary Washington College of the University of Virginia, at Fredericksburg, Va.; women's college of the university; state control; arts and sciences; before its annexation by the university in 1944, Mary Washington College was a teachers training school.
Marywood College, at Scranton, Pa.; Roman Catholic; for women; founded 1915; arts and sciences, education, home economics, library science, music; graduate school.
Masaccio (*mä-zät'chō*) (1401–28?), nickname of Tommaso Guidi (*gwē'dē*), Italian painter; among first to appreciate aerial perspective, to show figures in bold relief, and to introduce lively expressive action into painting: P-25*c*–*d*
'The Tribute Money' P-25*c*–*d*, *color picture* P-25*d*
Más Afuera, island in South Pacific. *See in Index* Juan Fernández
Masai (*mä-sī'*), an African Negroid people speaking a Hamitic language and living in Kenya and Tanganyika; noted for height and fine physique: K-34*b*, *picture* A-40, *color picture* A-35
Masaryk (*mä'sȧ-rik*), **Jan** (1886–1948), Czechoslovakian statesman, born Prague; minister to Great Britain 1925–38; lectured in U.S. 1939–40; foreign minister, Czechoslovak government 1940–48; died of fall from his apartment window in Prague after Communists came to power; son of Thomas Masaryk.
Masaryk, Thomas Garrigue (1850–1937), first president of Czechoslovakia M-122, C-536
Más a Tierra, island in South Pacific. *See in Index* Juan Fernández
Mascagni (*mäs-kän'yē*), **Pietro** (1863–1945), Italian composer M-122
'Cavalleria Rusticana', story O-390
Mascara (*mäs-kä-rä'*), fortified town in Algeria, about 45 mi. s.e. of Oran, on slope of Atlas Mts.; stands on site of Roman colony; pop. 26,086.
Mas'cot M-34
Mascouten, tribe of Indians of Algonquian family who lived in Wisconsin between Fox and Wisconsin rivers, in n. Illinois, in Indiana at mouth of Wabash River, and in lower Michigan peninsula; name means "little prairie people."
"Masculine protest" M-124*l*
Mas d'Azil, town in s. France
archaeological remains M-68
Masefield, John (born 1878), English poet, dramatist, and novelist M-122, E-382*b*
quoted M-122, E-382*b*
Mashie, a golf club, *pictures* G-138
Mashie shot, in golf, *picture* G-137
Mashonaland (*ma-shō'na-länd*), region, n.e. Southern Rhodesia; area about 80,000 sq. mi.; home of the Mashona, a Bantu people; chief city, Salisbury.
Mask, a covering to conceal or disguise the face
Greek actors' D-130, T-112
Indian, *color picture* I-108*c*
New Guinea devil chasers, *picture* M-35
Mask, an allegorical spectacle. *See in Index* Masque
Mask, gas. *See in Index* Gas mask
Maskelyne, Nevil (1732–1811), English astronomer royal, born London; did much to improve science of navigation; established *Nautical Almanac* 1766.
Maskinonge. *See in Index* Muskellunge
Mason, Charles (1730–87), English astronomer and surveyor; fixed

precise measure of a degree of latitude in America
Mason and Dixon's line M-123
Mason, Daniel Gregory (1873–1953), composer and writer on music, born Brookline, Mass., grandson of Lowell Mason; professor of music, Columbia University; compositions for violin, piano, orchestra ('From Grieg to Brahms', 'The Romantic Composers', 'Music in My Time').
Mason, Edith (Barnes) (born 1893), opera singer, born St. Louis, Mo.; sang in Milan and Paris, later with Metropolitan and Chicago opera companies.
Mason, George (1725–92), American Revolutionary War statesman, born Fairfax County, Va.; author of Virginia Bill of Rights and Constitution of 1776; member of Constitutional Convention.
Mason, James Murray (1798–1871), jurist and statesman, born Mason's Island, Va.; author of Fugitive Slave Law; Confederate commissioner to Great Britain 1861
Trent affair T-186
Mason, John (1586–1635), American colonist, born England
founder of New Hampshire N-154
secures grant in Maine M-56
Mason, John Young (1799–1859), statesman, born in Virginia; secretary of the navy 1844–45, 1846–49; U.S. minister to France 1854–59
Ostend Manifesto C-332
Mason, Lowell (1792–1872), musician, born Medfield, Mass.; pioneer of music instruction in public schools, and composer of hymn tunes ('Nearer, My God, to Thee').
Mason, Max (born 1877), educator and mathematician, born Madison, Wis.; invented devices for detecting submarines; taught at Massachusetts Institute of Technology, Yale, and University of Wisconsin; president University of Chicago 1925–28; president Rockefeller Foundation 1929–35; on faculty California Institute of Technology since 1936.
Mason, Stevens Thomson (1811–43), statesman, born Leesburg, Va.; governor of Michigan: M-229
Mason, Van Wyck (born 1897), novelist, born Boston, Mass. (tetralogy on American Revolution: 'Three Harbours', 'Stars on the Sea', 'Rivers of Glory', and 'Eagle in the Sky'; also detective stories about character Col. Hugh North).
Mason, Walt (1862–1939) American writer of humorous verse, born Columbus, Ontario; self-educated; daily prose poems in newspapers of U.S. and Canada ('Rippling Rhymes'; 'Horse Sense'; 'Terse Verse'; 'Walt Mason, His Book').
Mason, William (1829–1908), pianist, born Boston, Mass.; son of Lowell Mason; teacher of piano ('Memoirs of a Musical Life').
Mason and Dixon's line M-123
Mason ant, or **mound-building ant** A-253, 255, 257
Mason bee, solitary bee of the genus *Osmia;* constructs cells of clay under stones, in stems, and elsewhere.
Mason City, Iowa, railroad center and distributing city for agricultural, stock-raising, and quarrying district 110 mi. n. of Des Moines; pop. 27,980; cement, brick and tile, packed meat, beet sugar; railroad shops: I-220, *maps* I-215, U-253
Masonite, a manufactured wood W-186*d*
Masonry, brick B-304
Masonry nail, *picture* N-1
Masons, or **Freemasons,** secret fraternity F-283
Mason wasps, types that make mud nests W-53
Maspero (*mȧ-spŭ-rō'*), **Gaston Camille Charles** (*1846–1916*), French Egyptologist: professor Egyptology, Collège de France, Paris; headed government archaeological mission to Egypt 1880; director of excavations 1881; books on Egyptology.
Masqat, in Arabia. *See in Index* Muscat
Masque, or **mask,** an allegorical spectacle with singing, dancing, and elaborate settings; so called because actors originally wore masks; originating in Italy, the entertainment flourished in England in the 16th and 17th centuries, with Ben Jonson as the most popular writer, aided by Inigo Jones, the famous designer; Milton's 'Comus' best example: T-112
Jonson's work J-363
modern P-19*a*
mummers, or maskers, Old English C-296: play, *picture* C-298
Mass, in Roman Catholic church, the celebration of the *sacrament of the* Eucharist, commemorating the passion and death of Christ.
Mass, in physics, the amount of matter in a physical object; distinguished from the object's weight because weight varies with force of gravity; determined by comparison with some standard mass, as the standard kilogram: M-142*d*, G-173
atom, *table* A-460
convertible to energy E-344*f*–5: atomic power A-463–4
earth's mass E-192–3: measuring, *diagram* E-194
Massachu'set, Indian tribe that formerly lived in Massachusetts M-124, *map* I-106*f*, *table* I-107
Massachusetts, one of the New England states; 8257 sq. mi.; pop. 4,690,514; cap. Boston: M-123–40, *maps* M-132–3, 124, 127, U-253, 259, *pictures* M-123, 130, 135–6, 138–9
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Cape Cod C-118, M-137, *picture* M-139
Capitol, State (State House) B-257, *picture* M-135
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Concord C-430
Fall River F-15
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Lowell L-338
Lynn L-355
New Bedford N-136, *picture* N-136
Plymouth P-325–7, *pictures* P-325–7
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Springfield S-358
Worcester W-197
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Plymouth founded P-325–6: *Mayflower* M-145–7
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colonial religion: dissensions A-207–8: Roger Williams exiled W-140; Sunday observance A-210; Salem witchcraft persecutions W-180
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Maine made part of M-56
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gerrymandering G-104
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tree, state M-125
Massachusetts, University of, at Amherst, Mass.; state control; chartered 1863; opened 1867; became university in 1947: arts and sciences, agriculture, business administration, engineering, home economics, physical education.
Massachusetts Bay, arm of Atlantic indenting e. coast of Massachusetts, from Cape Ann on n. to Plymouth harbor on s.: *maps* M-124, 133
Massachusetts Bay Colony, a group of settlements around Massachusetts Bay founded by English Puritans on land granted in 1629 to Massachusetts Bay Company; John Winthrop, John Endicott, and John Cotton early leaders: M-137
government A-206
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religious foundations A-206
Thomas Beard, shoemaker S-163
Winthrop as governor W-161
Massachusetts Bay Company A-206
vessels of, *picture* U-369
Massachusetts Indians. *See in Index* Massachuset
Massachusetts Institute of Technology,

at Cambridge, Mass.; incorporated 1861; opened 1865; architecture, engineering, humanities, industrial management, science, social studies; graduate school; laboratory equipment permits experimentation almost on industrial scale: C-50, *picture* M-136
Massacre of St. Bartholomew (1572) C-382
Massacre of the Innocents, slaughter of the children of Bethlehem by Herod's soldiers J-339–40
Massa'lia, Greek name for Marseilles, France.
Massanet, Damian, Spanish priest, active as missionary in Mexico and Texas about 1690; founded important Texas missions: T-94
Massasau'ga (*Sistrurus catenatus*), a rattlesnake found in central and s.w. U.S.; body gray with brown splotches; length about 3 ft.
Mas'sasoit (1580?–1661), American Indian, chief of Wampanoags in Massachusetts; steadfast friend of Plymouth colonists
joined first Thanksgiving T-110, *picture* F-58
treaty with Pilgrims P-325
Massaua, or **Massawa** (*mäs-sä'wä*), seaport in Eritrea, on Red Sea; pop. 15,216; wireless station: *maps* E-402, A-46
Massays, Quentin. *See in Index* Matsys
Massecuite (*màs-kwēt'*), in sugar manufacturing S-444
Masséna (*mà-sā-nà'*), **André** (1756?–1817), duke of Rivoli and prince of Essling, perhaps the greatest of Napoleon's marshals, called by him "spoiled child of victory"; victorious in Italy, Poland, Germany; first serious defeat by Wellington in 1810 in Peninsular War; thereafter saw no active service.
Massena, N. Y., village on Grass River, 35 mi. n.e. of Ogdensburg in agricultural and dairying region; pop. 13,137; aluminum and mica plants, silk mills: *map* N-205
Massenet (*mà-sŭ-nĕ'*), **Jules Émile Frédéric** (1842–1912), French composer of songs, operas, orchestral works; his distinctive style appears best in love scenes of his operas
'Le Jongleur de Notre Dame', story O-390
'Manon', story O-391
'Thaïs', story O-393–4
Massey, Hart Almerrin (1823–96), Canadian manufacturer and philanthropist, born Haldimand, Upper Canada; manufactured agricultural implements; left large endowments to public institutions in Toronto.
Massey, Vincent (born 1887), Canadian statesman and public official, born Toronto; minister to U.S. 1926–30; high commissioner for Canada in United Kingdom 1935–46; became chancellor University of Toronto 1947; appointed governor general of Canada 1952: C-103
Massil'ia, Roman name for Marseilles.
Mas'sillon, Ohio, industrial city 100 mi. n.e. of Columbus; pop. 29,594; trade in coal, sandstone, grain, and livestock; iron and steel products, aluminum cooking utensils, furnaces: *map* O-356
'Mass in B minor', chorale by Bach M-461
Massine (*mà-sēn'*), **Leonide** (born 1896), ballet dancer and choreographer, born Moscow, Russia; studied with Fokine; joined Diaghilev's ballet at 17; first New York appearance 1916: B-28*a*, *picture* B-28*c*
'Red and Black', ballet, *picture* B-28*b*
Mas'singer, Philip (1584–1640), English dramatist; author of 15 plays and collaborator with John Fletcher and others in many more; plays have an obvious moral intention, but his heroes are too good and his villains too wicked to be convincing ('A New Way to Pay Old Debts').
Massive, Mount, peak of Sawatch Range of Rocky Mts. in central Colorado (14,418 ft.): *maps* C-402, 408
Mass loss in binding R-54*c*
Mass magazines M-29
Mass number, atoms A-458–9, R-54*a*
Masson (*mà-sôṅ'*), **Antoine** (1636–1700), French engraver E-387
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American industry
advertising stimulates A-23
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monopolistic tendency M-359
shoes S-164–5
Whitney father of W-132
Mass spectrograph, for measuring mass of atoms, *diagram* A-459
Massys, Quentin. *See in Index* Matsys
Mast, nuts borne by beech, oak, and other forest trees (acorns, beechnuts) B-101
Mast, ship's S-151
Mastaba (*măs'tä-bä*), an ancient tomb built above ground P-447
Master, a university degree U-400
origin U-404
"Master, remember the Athenians" P-158
Masters, Edgar Lee (1869–1950), author, born Garnett, Kan.; achieved wide fame with 'Spoon River Anthology' (1915), a collection of poems in free verse; practiced law in Chicago after 1891 ('Domesday Book'; 'The Fate of the Jury', poetry; 'Children of the Market Place', novel; 'Lincoln, the Man' and 'Vachel Lindsay, a Poet in America', biography): A-230*c*
Mastersinger (*meistersinger*) M-460
Mastersongs G-83
Mas'tic, a resin G-232, P-41
Mastication, or chewing, of food H-303, D-90
Mastiff, a dog, *table* D-118*b*
bull mastiff, *table* D-118*a*
great Dane, or German mastiff, *color picture* D-116, *table* D-118*a*
Mas'todon, a hairy, elephantlike animal now extinct M-62, *picture* P-407
Mastoid process, a projection of the temporal bone above and behind the ear; sometimes called the mastoid bone: S-192, *picture* E-171
Masulipatnam, or **Masulipatam,** also **Bandar,** seaport of India in Andhra state, on one of the mouths of Kistna River; pop. 59,146; weaving, bleaching, cloth printing, and rug making: *map* A-407
Masu'rian Lakes, a sickle-shaped group of lakes in s. part of former province, East Prussia (after 1945 part of n.e Poland); strategically important in Hindenburg's e. campaigns in World War I
battles of W-221, *map* W-222
Masurium, former name of technetium, a chemical element.
Matabeleland (*măt-a-bē'lē-lănd*), region, s.w. Southern Rhodesia; area about 70,000 sq. mi.; home of the Matabele, a Zulu people; chief city, Bulawayo
native revolt R-144
people, Matabele, *picture* A-39, *color picture* A-35
Matadi (*mą-tä'dē*), chief seaport of Belgian Congo; on Congo River about 95 mi. from mouth; limit of navigation for ocean ships; w. terminal of Matadi-Léopoldville railroad; pop. 48,351: C-434*d*, *maps* A-47, B-109
Mat'ador, in bullfights, the man who kills the bull, *picture* S-317
Matagor'da Bay, inlet of Gulf of Mexico at mouth of Colorado River, indenting s. coast of Texas: *map* T-91
La Salle's settlement L-105, T-94
Matagorda Island, long narrow island off coast of Texas, s.w. of Matagorda Bay: *maps* T-78, 91
Matamo'ras, river port of Mexico on Rio Grande opposite Brownsville, Tex.; pop. 45,776; captured by Zachary Taylor in Mexican War (1846): *map* M-195
Matan, famous diamond, *picture* D-79
Matanuska Valley, in southern Alaska, formed by the Matanuska and Susitna rivers A-132
homestead colony A-134, *map* A-135
Matanzas (*mä-tän'säs*), seaport and railroad center on n. coast of Cuba, 50 mi. e. of Havana; pop. 82,646, with suburbs; chief export, sugar: *maps* C-528, W-96
Matanzas River, or **Matanzas Bay,** inlet of Atlantic in e. coast of Florida, on which St. Augustine is situated
Fort Matanzas National Monument N-34, *map* N-18
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early matches M-140, *pictures* F-75
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why easy to blow out F-74
Matchlock, early hand gun F-76, *pictures* F-77
Match play, in golf G-136
Maté, or **yerba maté,** also called Paraguay tea T-30, 32, *picture* S-250
Matelasse (*măt-lä-sā'*), a fabric with a raised design which gives a padded effect; usually silk or silk and wool in a solid color; of Jacquard weave; used for dresses, wraps, and trimmings, heavier types for draperies and upholstery; name French for "cushioned."
Materialists, in philosophy P-203
Materials, strength of. *See in Index* Strength of materials
Mate'ria med'ica (Latin words meaning materials of medicine), that part of the study of medicine which deals with the source, preparation, and use of drugs.
Mathematical geography G-45
Mathemat'ics, the science of number and quantity M-142
algebra A-154–64, *pictures* A-155
Arabs' contributions M-331
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exponent. *See in Index* Exponent
geometry G-60–6, *diagrams* G-60–4
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Great Britain: Maxwell's field equations M-143; Napier invents table of logarithms L-296; Newton develops calculus N-193
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Sumerians G-65
trigonometry T-187-9, *diagrams* T-187-9

Mather (*măth'ẽr*), **Cotton** (1663-1728), preacher and scholar, born Boston; son of Increase Mather; leader of conservative New England Puritans and of Salem witchcraft persecution; historian of New England ('Wonders of the Invisible World'; 'Magnalia Christi Americana'): A-225

Mather, Increase (1639-1723), clergyman and author, born Dorchester, Mass.; pastor of North Church, Boston, for 62 years; president of Harvard College 1684-1701 ('Remarkable Providences'; 'A Brief History of the War with the Indians in New England').

Matheson, Samuel Pritchard (1852-1942), Canadian Anglican prelate; dean of St. John's Cathedral, Winnipeg, and archbishop of Rupert's Land; primate of Canada 1909-31.

Mathew (*măth'ū*), **Theobald** (1790-1856), "Father Mathew," Irish (Capuchin) priest and temperance reformer; worked among the poor in Ireland; also campaigned for temperance in England and America.

'Mathew', John Cabot's ship C-8

Mathews, Shailer (1863-1941), Biblical scholar, theologian, and educator, born Portland, Me.; dean of Divinity School, University of Chicago 1908-33 ('The Church and the Changing Order'; 'The French Revolution'; 'The Faith of Modernism'; 'The Student's Gospels'; 'New Faith for Old—an Autobiography').

Mathewson, Christy (1880-1925), baseball pitcher, born Factoryville, Pa., *picture* B-64. *See also in Index* Baseball Hall of Fame, *table*

Mathiola (*mă-thī'ō-lą*), a genus of plants including the stock. *See also in Index* Stock

Matil'da (died 1083), queen of William I of England and daughter of Baldwin V, count of Flanders W-137

Matilda (1080-1118), queen of Henry I of England and daughter of Malcolm III and St. Margaret of Scotland H-335

Matilda (1102-67?), queen of England (crowned 1141), daughter of Henry I of England: S-390
besieged at Oxford O-432

Matin (*măt'in*), a morning service or prayer
monastic churches M-355, 356

Matisse (*mă-tēs'*), **Henri** (1869-1954), French artist, best known as painter and lithographer; one of leaders of post-Impressionist school; turned to Modernism after a period of academic painting; distinguished for simplification of drawing, skillful composition, broad sweeps of color, and decorative pattern
'Head of a Girl with Braids' D-140*b-c*, *picture* D-140*c*
'Piano Lesson' P-34*b*, *color picture* P-34*a*

Mato Grosso (*măt'ū grō'sō*), or **Matto Grosso** (meaning great forest), large state of central Brazil, little settled and partly unexplored; 485,-405 sq. mi.; pop. 528,451; cap. Cuiabá: B-292
plateau B-288, *map* B-288

Matriarchate, a society in which the mother rules F-18*a*

Matrilineal (*mă-trĭ-lĭn'ē-ăl*) **family** F-18*b*

Matrilocal (*măt-rĭ-lō'kăl*) **family** F-18*b*

Matrimony vine, an ornamental spiny shrub (*Lycium vulgare*) of the nightshade family with long slender climbing or trailing branches and showy pale-purple, bell-shaped flowers, which are followed by orange-red berries.

Matrix, in type casting T-229
Linotype L-257, 258-9
Monotype M-362
stereotype S-393

Matronymic, mother-name N-2*b*

Matsuoka (*măt-sọ-ō'kạ*), **Yosuke** (*yō'-sọ'kĕ'*) (1880-1946), statesman, born Yamaguchi, Japan; went to Portland, Ore., 1893; brought up in Christian religion by Scottish family; law degree University of Oregon 1900; returned to Japan about 1901; in foreign service 1904-20; after 1929 prominent in Japan's Manchurian policy and one of first to advocate imperialistic militarism; adviser to Premier Konoye 1937; foreign minister 1940-41.

Matsys (*măt-sīs'*), also **Massys**, or **Massays**, **Quentin** (1466-1530), Flemish realistic artist; noted for religious subjects and portraits ('Burial of Christ', in Antwerp museum; 'Virgin and Child', 'Story of St. Anne', in Brussels gallery; 'Money Changer and His Wife', in Louvre, Paris, France).

Mattagami, river in Ontario, Canada, 275 mi. long, tributary of Moose River.

Mattathi'as (died 167 B.C.), Jewish priest J-353

Matte (*măt*), impure metal produced by smelting
in copper smelting C-474

Matte process, in motion pictures M-418, 420, *pictures* M-415, 417

Matter, in physics, anything having properties such as weight and extension identifiable by the senses; contrasted in physical theory with energy, which is recognizable only through its effects on matter: M-142*a-h*, *pictures* M-142*a-h*, *Reference-Outline* P-237
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Matterhorn (*mä'tẽr-hôrn*) (French Mont Cervin), peak in Alps on w. frontier between Switzerland and Italy; 14,780 ft.: S-479, *map* S-475, *picture* S-478

Matthay (*măt'ā*), **Tobias** (1858-1945), pianist and teacher, born in London, England, of German parents; developed system of piano teaching; became one of world's noted teachers.

Matthew, Saint, apostle and traditional author of the First Gospel; festival September 21: A-275

Matthew, Gospel of Saint, first of the Four Gospels and first book of the New Testament.

Matthew of Paris (1200?-1259), English chronicler and monk of St. Albans; his 'Chronica maiora' is a vivid picture of life in Middle Ages, although not always accurate.

Matthews, Francis Patrick (1887-1952), lawyer and businessman, born Albion, Neb.; president of U.S. Chamber of Commerce, 1938-39, later a director; secretary of navy 1949-51; U.S. ambassador to Ireland 1951-52.

Matthews, (James) Brander (1852-1929), man of letters, born New Orleans, La.; professor at Columbia University after 1892; dramatic criticism, essays, plays ('Shakespeare as a Playwright'; 'Principles of Playmaking'; 'Molière: His Life and His Works').

Matthews, William (1822-96), bookbinder and writer on bookbinding, born Aberdeen, Scotland; emigrated to New York 1843; noted for workmanship and for knowledge of the history of his craft.

Matthi'as, one of the apostles; commemorated as saint Feb. 25: A-275

Matthias I. Hunyadi (1440-90), king of Hungary, also called Matthias Corvinus from the raven (*corvus*) on his escutcheon; son of Janos Hunyadi; elected king 1458, repeatedly defeated Emperor Frederick III, Turks, Poles, and became most powerful ruler in central Europe: capable as soldier, administrator, orator, lawmaker: H-450

Matthioli (*măt-tē-yōl'ē*), supposed "Man in the Iron Mask" I-249

Matthison, Edith Wynne (Mrs. Charles Rann Kennedy) (born 1875), American actress, born in England; Shakespeare, Greek, and old English revivals ('Everyman'; 'Trojan Women'), modern drama.

Matto Grosso, state, Brazil. *See in Index* Mato Grosso

Mattoon', Ill., city 70 mi. s.e. of Springfield; pop. 17,547; broom corn, fruit, and livestock interests; brooms, shoes, foundry products, and diesel engines; railroad shops: *map* I-37

Matura diamond, a colorless or decolorized zircon from Ceylon used as a gem.

Maturation (*măt-ū-rā'shŭn*), in child development C-239-40

Maturity M-142*i-l*, *pictures* M-142*i-l*
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physical. *See in Index* Child development, *subhead* physical growth
training for C-245-8, *pictures* C-245-8

Matzoth (*măt'sōth*), or **matzos**, unleavened bread P-94

Maubeuge (*mō-bûzh'*), France, fortified town near Belgian border, 50 mi. s.e. of Lille; pop. 20,310; taken by Germans 1914 and 1940: *map* B-111

Maude, Sir (Frederick) Stanley (1864-1917), British general in World War I; took part in Dardanelles and Kut-al-Amara relief expeditions
captures Baghdad W-226

'Maud Muller', poem by Whittier about the shy, pretty Maud Muller.

Maudsley, Henry, inventor of lathe slide rest T-153

Maugham (*mąm*), **(William) Somerset** (born 1874), English novelist, short-story writer, and dramatist; born Paris, France; studied medicine but did not practice; spent much of life abroad—France, the Orient, America; work distinguished by irony and fine portrayal of character ('Of Human Bondage', 'The Moon and Sixpence', 'The Razor's Edge', 'Then and Now', 'Catalina', novels; 'The Circle', 'The Constant Wife', plays; 'Complete Short Stories'; 'The Vagrant Mood', essays; 'Writer's Notebook'): E-383

Mau Mau, a secret society in Africa K-35

Maui (*mou'ē*), one of the Hawaiian Islands; 728 sq. mi.; pop. 40,103: H-288–288*a*, *maps* H-286, P-17
- Haleakala volcano N-35, H-288, *map* H-286, *picture* H-287

Mauldin, Bill (William Henry) (born 1921), cartoonist. born Mountain Park, N. M.; in U. S. Army 1940–45; on *45th Division News* and *Stars and Stripes*, army publications; awarded Pulitzer prize 1945 for cartoons ('Mud, Mules and Mountains'; 'Up Front'; 'Back Home'; 'Bill Mauldin's Army').

Mau'mee, River, flows into Lake Erie near Toledo, Ohio, after course of 150 mi. through n.e. Indiana and n.w. Ohio: *maps* O-348, 356, I-78

Mauna Kea (*mä'ǫ-nä kä'ä*) (Hawaiian "white mountain"), extinct volcano on island of Hawaii; highest peak in Pacific islands (13,784 ft.): H-288, *map* H-286
- height, comparative. *See in Index* Mountains, *table*

Mauna Loa (*lō'ä*) ("great mountain"), active volcano on island of Hawaii, part of Hawaii National Park; 13,680 ft.: H-288, N-35, *color picture* N-28, *maps* H-286, P-17

Maundy Thursday, or Holy Thursday E-200

Maunoury (*mō-no-rē'*), **Michel Joseph** (1847–1923), French general, recalled from retired list in 1914; commanded VI Army, which turned Von Kluck's left flank at first battle of Marne.

Maupassant (*mō-pä-sän'*), **Guy de** (1850–93), French novelist of the naturalistic school, one of the greatest masters of the short story; portrayed human character as he saw it, without pointing a moral; because of a nervous malady which finally led to insanity and death, many of his later works are morbid ('The Piece of String'; 'The Necklace'; 'A Life'; 'Pierre and Jean'): F-289, *picture* F-287

Maurandia, a genus of perennial plants of figwort family, climbing by means of the leaf stems; native to Mexico and s.w. U.S. Related to snapdragon; leaves triangular; flowers irregular trumpet-shaped, white through blue.

Maurepas (*mō-rŭ-pä'*), **Lake**, s.e. Louisiana; 13 mi. long; connected with Lake Pontchartrain by 3 mi. channel: *maps* L-331, 333

Mauretania. *See in Index* Mauritania

'Mauretania', ocean liner S-156

Mauriac (*mō-rē-yäk'*), **François** (born 1885), French author; awarded 1952 Nobel prize for literature ('Therese'; 'The Desert of Love'; 'The Kiss to the Leper'; 'Genetrix'): F-290

Maurice of Nassau (1567–1625), prince of Orange (son of William the Silent), Dutch general, one of ablest of his age; successfully resisted Spanish domination.

Maurice of Saxony (1521–53), duke and, by conquest of his cousin John Frederick, elector of Saxony; one of foremost generals and most cunning diplomats of his day; extorted from Emperor Charles V Treaty of Passau (1552), giving Protestants liberty of worship until Diet of Augsburg.

Maurice River, in s. New Jersey; flows s. into Delaware Bay; navigable to Millville: *maps* N-156, 165

Mauritania (*mǫ-rĭ-tā'nĭ-ą*), also **Mauretania**, ancient name for n.w. Africa, comprising modern Morocco and w. Algeria; in time of Caesar an independent kingdom; later a Roman province.

Mauritania, a territory in French West Africa; approximately 450,000 sq. mi.; pop. 524,000; administered from Saint Louis in Senegal; cattle, gums, salt: *map* A-46

Mauritius (*mǫ-rĭsh'ŭs*), formerly **Ile de France**, island in Indian Ocean; British colony; 720 sq. mi.; pop. 419,185; cap. Port Louis: M-143, *map* A-407
- dodo D-109, *picture* D-109
- postage stamps, *picture* S-364

Mauritshuis (*mou'rits-hois*), picture gallery, The Hague H-242

Maurois (*mōr-wä'*), **André** (born 1885), French writer, born Emile Herzog; popular for fictionized biographies; liaison officer in British army in World War I, in French army in World War II; in U.S. much of time after 1940 ('Ariel, or the Life of Shelley'; 'Life of Disraeli'; 'Don Juan, or the Life of Byron'; 'Seven Faces of Love'; 'Lélia'; 'I Remember, I Remember', autobiography): *picture* F-289

Maurras (*mō-ras'*), **Charles** (1868–1952), French critic and journalist, a stanch nationalist; he preached discipline in art, politics, morality; influenced Italian Fascisti; imprisoned Feb. 1945 for collaboration with Germans ('Trois idées politiques'; 'Les amants de Venise', 'Jean Moréas'; 'L'Etang de Berre').

Maury (*mą'rĭ*), **Matthew Fontaine** (1806–73), oceanographer and meteorologist, born Spotsylvania County, Va.; first to advocate uniform system of recording data to guide ocean vessels; furnished, in words of Cyrus Field, brains for laying the first Atlantic submarine cable ('Physical Geography of the Sea')
- at Virginia Military Institute V-489
- Hall of Fame, *table* H-249

Mäuseturm. *See in Index* Bingen, Germany

Mausole'um at Halicarnassus S-105

Mausolus (*mą-sō'lŭs*) (4th century B.C.), king of Caria, whose wife Artemisia erected famous "mausoleum" at Halicarnassus to his memory S-105

Mauve (*mou-vĕ*), **Anton** (1838–88), Dutch landscape and animal painter, chiefly self-taught; most celebrated for his quiet rural scenes in Holland which he interpreted with insight and feeling.

Mauve (*mōv*), a delicate purple or lilac color; also a purple dye
- first aniline dye D-166

Mauvoisin Dam, in Switzerland, on Drance River. *See in Index* Dam, *table*

Mavericks, unbranded cattle on the range C-150

Mavis (*mā'vis*), the song thrush T-126

Mavor, James (1854–1925), Canadian political economist, born in Scotland; professor of political economy, University of Toronto 1892–1923; author of government reports on immigration and on Canada's wheat-producing capacity.

Mawenzi, Mount, in Tanganyika Territory. *See in Index* Kilimanjaro

Mawson, Sir Douglas (born 1882), Australian explorer and geologist, born England; one of two members of Shackleton's expedition who located south magnetic pole; commanded expeditions to Antarctic
- Antarctic exploration A-260, *table* P-349

Max, of Baden, Prince. *See in Index* Maximilian, prince of Baden

Max, Adolphe (1869–1939), burgomaster of Brussels at beginning of World War I; for 3 months, until imprisoned in Germany, heroically resisted Germans who occupied city; afterward member Belgium Chamber of Representatives and minister of state.

Maxen'tius, Marcus Aurelius Valerius (died 312), elected Roman emperor, West, A.D. 306
- Constantine defeats C-456

Maxil'la, or **superior maxilla**, bone of the upper jaw S-192

Maxil'lae, biting jaws of insects I-155

Maxil'liped, of crawfish, *picture* C-507

Maxim, Hiram Percy (1869–1936), inventor, born Brooklyn, N. Y.; invented Maxim silencer for firearms, and applied principle to silencing other noises; founded (1914) the American Radio Relay League, president 1914–36; son of Sir Hiram Stevens Maxim and nephew of Hudson Maxim.

Maxim, Sir Hiram Stevens (1840–1916), inventor, born Sangerville, Me.; invented Maxim automatic machine gun; became British subject in 1900; brother of Hudson Maxim: *picture* R-203

Maxim, Hudson (1853–1927), inventor, born Orneville, Me.; invented explosives and was first to make smokeless gunpowder in U. S.; brother of Hiram Stevens Maxim.

Maxim gun M-9

Maximil'ian I (1459–1519), Holy Roman emperor A-496
- marries daughter of Charles the Bold C-196
- tomb M-177

Maximilian I (1756–1825), first king of Bavaria; succeeded as elector 1799; aided Napoleon and received title of king as a reward.

Maximilian II (1811–64), king of Bavaria, monarch of liberal tendencies; succeeded to throne on abdication of his father 1848; opposed exclusion of Austria from German confederation; father of the mad kings Ludwig II and Otto.

Maximilian (1832–67), archduke of Austria and emperor of Mexico; younger brother of Emperor Francis Joseph; established on Mexican throne 1864 by France: M-206

Maximilian I, the Great (1573–1651), elector and duke of Bavaria, helped form Catholic League which opposed Protestant Union in Thirty Years' War; party to peace of Westphalia 1648; considered ablest Catholic ruler of his time.

Maximilian, prince of Baden (Max of Baden) (1867–1929), German soldier and statesman; as imperial chancellor (appointed Oct. 3, 1918), he began negotiations for armistice; brought pressure on Kaiser William II and forced him to abdicate; gave government control to Friedrich Ebert Nov. 1918.

Maximilian Alexander Philipp, prince of Wied-Neuwied (1782–1867), German soldier and traveler; general in Prussian army; explored Brazil; traveled in United States ('Travels in the Interior of North America').
Maxixe (*mà-shē'shä*), a dance L-116
Maxwell, James Clerk (1831–79), Scottish physicist M-143, *picture* E-308
electrical theories M-143, E-309, P-235, R-42: electromagnetic wave theory of light R-29
May, Phil (1864–1903), English black-and-white artist, skilled in using the fewest possible lines: chiefly depicted "low life" in London.
May, English name for hawthorn H-294
May, month M-143
birthdays of famous persons. *See in Index* Birthdays, *table*
birthstone, *color picture* J-348
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May, Cape, southernmost part of New Jersey, *maps* N-156, 165, U-253
Maya. *See in Index* Mayas
Mayaguana, one of southernmost of Bahama Islands; area 96 sq. mi.; pop. about 1000: *maps* B-17, W-96
Mayagüez (*mä-yä-gwās'*), Puerto Rico, city on w. coast; pop. 58,944; railway connection with interior; export trade: P-434, *map, inset* W-96*a*
Mayakovsky (*mä-yä-kôf'ski*), **Vladimir** (1893?–1930), Russian poet and dramatist
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Mayapan (*mī-yä-pän'*), ancient city of Yucatán; Mayan ruins.
May apple M-143*a*, *color pictures* F-169, P-286
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Mayas (*mä'yąz* or *mī'ąs*), American Indians M-143*a*–4, Y-344–5, C-172–3, *pictures* M-143*a*–4
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May beetle, or **June bug** J-364, N-52
May Day, festival M-143
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parade in Moscow, *pictures* M-397, R-292
Robin Hood's festivals R-165
Russia R-271, *picture* R-274
Mayence, Germany. *See in Index* Mainz
Mayer (*mī'yẽr*), **Julius Robert von** (1814–78), German physician and physicist; first to suggest theory of conservation of energy; applied mechanical theories to study of animal heat.
Mayfair, district in London, England L-305
Mayflower. *See in Index* Arbutus, trailing
'Mayflower', Pilgrims' ship M-145–7, *pictures* M-145, 147
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signing, *picture* M-147
Mayflower Descendants, Society of M-146
Mayfly, shad fly, or **day fly** M-147, *color picture* I-154*c*
Mayhew (*mā'hū*), **Jonathan** (1720–66), clergyman, born Martha's Vineyard, Mass.; upheld cause of colonies in sermons; said to have made first suggestion of united action by colonies: U-371
"May laws," against Jews J-354
Maynor, Dorothy (born 1910), Negro soprano, born Norfolk, Va.; debut in New York City 1939; appeared in recital and with leading symphony orchestras of United States; sympathetic interpretation of Negro spirituals.
Ma'yo, Henry Thomas (1856–1937), rear admiral U.S. Navy, retired in 1920; graduate of U.S. Naval Academy; admiral and commander in chief Atlantic fleet 1916–19; of U.S. fleet 1919; reverted to rear admiral upon division of fleet
Tampico incident (1914) M-207
Mayo, William James (1861–1939), surgeon, born Le Sueur, Minn., and **Charles Horace Mayo** (1865–1939), surgeon, born Rochester, Minn., brothers who developed famous Mayo Clinic; established Mayo Foundation for Medical Education and Research (1915), now a department of University of Minnesota for graduate work. *See also in Index* Mayo Clinic
Mayo, William Worrall (1819–1911), surgeon, born Manchester, England; to U. S. 1845; located in Rochester, Minn., 1863; father of William J. and Charles H. Mayo. *See also in Index* Mayo Clinic
Mayo, 3d largest county in island of Ireland (2084 sq. mi.) in Connaught Province, Ireland; bounded n. and w. by Atlantic; pop. 141,867; mountainous in w., flat in e.; cattle, salmon, linen: *map* I-227
Irish Land League B-272
Mayo Clinic, surgical and medical clinic at Rochester, Minn.; created through joint efforts of William W. Mayo and his sons, William J. and Charles H., who began practicing together in St. Mary's Hospital 1889; name in informal usage after 1905 when other doctors were added to staff; first Mayo Clinic building opened 1914; attended by large numbers of surgeons and physicians, many of whom do graduate work: M-278, 280
Mayon (*mä-yōn'*), volcano in Philippines P-193, *map* P-195
Mayonnaise (*mā-ō-nāz'*), sauce made of eggs, edible vegetable oil, and seasoning; used chiefly as salad dressing
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May'or, chief executive of American villages, towns, and cities M-451
Mayor-council government, in American cities M-451
Mayor of the Palace (*major domus*), official in Frankish kingdom under Merovingian rule
Charles Martel C-196
founds Carolingian dynasty F-268
Pepin the Short C-186
Mayotte, island off e. Africa. *See in Index* Comoro Islands
Maypole M-143
dance D-131, F-192*b*
Maypop, or **passionflower** P-94, *picture* P-94
pollen grain, *picture* F-186
Maywood, Calif., city 6 mi. s. of Los Angeles, on Los Angeles River; pop. 13,292; chiefly residential city for surrounding industrial area: *map, inset* C-35
Maywood, Ill., suburb of Chicago on Des Plaines River 10 mi. w. of Chicago; pop. 27,473; makes tin plate and cans, ginger ale; metal hose; lithographing: *map, inset* I-36
Mazagan (*màz-à-gän'*), French Morocco, seaport 50 mi. s.w. of Casablanca; agricultural products; pop. 34,781: *maps* A-167, A-46
Mazama, Mount, extinct volcano
Crater Lake in N-33
Mazarin (*mà-zà-răṅ'*), **Jules** (1602–61), French cardinal and statesman, born Italy; favorite of Anne of Austria; French premier under Louis XIV; continued Richelieu's policy of weakening nobility at home and Hapsburgs abroad: L-319
introduces opera to France O-388
Mazarin Bible. *See in Index* Forty-two-line Bible
Mazar-i-Sharif (*mà-zär' ĭ shär-ēf'*), Afghanistan, also **Mazar-i-Sherif**, fortified city and important military post; pop. 41,960; its mosque is venerated as tomb of Ali, son-in-law of Mohammed: *map* A-406
Mazar Province, or **Afghan Turkestan**, in n. Afghanistan; area about 20,000 sq. mi.; pop. about 945,000: T-214
Mazatlán (*mä-sät-län'*), Mexico, port on w. coast at entrance to Gulf of California; pop. 41,470; outlet for agricultural and mining region: M-190, *maps* M-189, 194
Maz'da, or **Ahura Mazda**, in Zoroastrianism Z-365
Mazda electric lamps E-310
Maze, a confusing network of tunnels, paths, etc.; small models used to test learning ability: L-144–5, *picture* L-146. *See also in Index* Labyrinth
Mazeppa (*mä-zĕp'ą*), **Ivan** (1644–1709), Cossack chief, powerful in Russia during reign of Peter the Great; deserted to Charles XII of Sweden; subject of a poem by Byron and of a symphonic poem by Liszt.
Mazurka (*mą-zûr'ką*), a national Polish dance in triple time with moderate tempo, danced by four or eight couples; spread to other countries after 18th century; also music in its rhythm, notably mazurkas for piano by Chopin. *See also in Index* Music, *table* of musical terms and forms
Mazzei (*mät-sĕ'ē*), **Philip** (1730–1816), physician and merchant, born Florence, Italy; settled in Virginia 1773 and became naturalized; delivered fiery speeches and wrote articles fostering American freedom; returned to Europe 1785 and became Polish citizen but kept in close touch with Thomas Jefferson and American leaders.
Mazzini (*mät-sē'nē*), **Giuseppe** (1805–72), Italian patriot M-148
influence on papacy P-277
sets up republic I-272–3, M-148
Mboma, Belgian Congo. *See in Index* Boma
Mbomu River, Belgian Congo. *See in Index* Bomu
MDAP. *See in Index* Mutual Defense Assistance Program
M-Day, in U. S. Army, first day of general mobilization.
Me, a personal pronoun
correct use of P-418
Mead, Larkin Goldsmith (1835–1910), sculptor, born Chesterfield, N. H.; feeling and great detail but rough modeling (Lincoln monument at Springfield, Ill.).
Mead, Margaret (born 1901), anthropologist, born Philadelphia, Pa.; assistant curator of ethnology American Museum of Natural History, New York City, 1926–42, associate curator from 1942 ('Coming of Age

in Samoa'; 'Male and Female, a Study of the Sexes in a Changing World').

Mead, William R. (1846–1928), architect, born Brattleboro, Vt. *See also in Index* McKim, Charles F.

Mead, Lake, in s.e. Nevada, at Hoover Dam (in Black Canyon of Colorado River), 119 miles long, storage capacity 32,359,274 acre-feet; named for Dr. Elwood Mead, commissioner of reclamation while Hoover Dam was being constructed; has become a recreation center: D-11*b*, *maps* N-133, U-303
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Meade, George Gordon (1815–72), American Civil War general M-148
Gettysburg G-105, 106, M-148, C-335

Meader, Stephen Warren (born 1892), journalist and author of books of adventure and outdoor life for boys; born Providence, R. I. ('Longshanks'; 'Thunder Country').

Meade's Ranch, in Kansas, surveying station S-458

Meadow beauty, or deergrass, a genus of wild flowers (*Rhexia*) of the melastoma family, with square or round stems, opposite narrowly oval leaves and purple or yellow flowers with protruding stamens; found in bogs of North America.

Meadowcroft, Enid La Monte (born 1898), teacher and author, born Cranford, N.Y.; children's books, historical stories, and human biographies of great Americans ('Abe Lincoln and His Times'; 'On Indian Trails With Daniel Boone'; 'By Secret Railway'; 'Texas Star').

Meadow fescue, a perennial plant (*Festuca elatior*) of the grass family, native to Eurasia but naturalized in cooler parts of N. America; tall with flat leaves; flower clusters, much-branched and nodding; used as hay and pasture crop.

Meadowlark M-148, *picture* N-54, *color pictures* B-167, 184
egg M-148, *color picture* E-268*a*
nest, *color picture* B-167
state bird, *table* B-158

Meadow mouse, or field mouse M-441
balance of nature N-63
bird enemies B-158

Meadow rue, or Thalictrum (*thạ-lĭk'-trŭm*), a genus of perennial plants of the buttercup family, found chiefly in temperate regions. Erect-growing with finely cut leaves, similar to maidenhair fern; flowers in feathery clusters, tiny, greenish white, purple, or yellow.

Meadow saffron. *See in Index* Colchicum

Meadowsweet, a perennial plant of the rose family, genus *Spiraea* (sometimes classed as *Filipendula*); white or pink flowers in pyramidal, plumy clusters at top of stems of shrub 2 to 6 ft. high.

Meadville, Pa., city 86 mi. n. of Pittsburgh; pop. 18,972; in agricultural and iron and steel manufacturing region; railroad shops; slide fasteners, rayon yarn, machinery; Allegheny College: *maps* P-132, U-253

Meagher, Thomas Francis (1823–67), Irish revolutionary leader and American soldier; one of founders of Irish Confederation; sentenced to life imprisonment for revolutionary efforts against England; escaped to New York City; during Civil War organized Irish brigade; attained rank of brigadier general; made secretary of Montana territory at close of war.

Mealies, South African name for Indian corn C-480

Meals H-303. *See also in Index* Cooking; Food

Mealy bug, a scale parasite S-54

Mean, a measure of average S-385*e*

Mean'der, the winding course of a river R-156, *diagram* E-188, *picture* R-156

Meander River, also Maeander, now called Menderes (*mĕn-dĕ-rĕs'*), river in Asia Minor; famous for its many windings which made its name proverbial; 240 mi. to its mouth at (ancient) Miletus on the Aegean: *maps* G-197, T-215

Means, Florence Crannell (born 1891), author of books for girls, born Baldwinsville, N.Y. ('Candle in the Mist'; 'Shuttered Windows'; 'Shadow Over Wide Ruin'; 'Hetty of the Grande Deluxe').

Mean solar time T-136

Meany, George (born 1894). labor leader, born New York City; became journeyman plumber 1915; president New York State Federation of Labor 1934–39; secretary-treasurer American Federation of Labor 1940–52, president after Nov. 1952: L-71, *picture* H-381

Meares, John (1756?–1809), English navigator; explored coast of Alaska; sailed to China by way of Hawaiian Islands
Columbia River O-410

Mearne, Samuel and Charles, English bookbinders B-241

Measles, a contagious disease common among children D-102
control, *pictograph* H-309
immunization D-103
mode of infection D-102

Measly meat W-302

Measure, in music. *See in Index* Music, *table* of musical terms and forms

'Measure for Measure', comedy by Shakespeare in which Angelo, deputy for Vincentio, duke of Vienna, plots against Claudio and Isabella. The duke, disguised as a friar, rescues Isabella from Angelo's intrigue, saves her brother Claudio from execution; then, in his own character, weds Isabella and compels Angelo to marry his jilted sweetheart, Mariana
chronology and rank S-129

Measurement, or mensuration, a branch of arithmetic M-149–52, *diagrams* M-149–52
accuracy of instrument S-385*c*
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Measurements and tests. *See in Index* Achievement tests; Intelligence tests

'Measure of the tithe', in feudal system, *picture* M-238

Measures. *See in Index* Weights and measures

Measuring worm, or cankerworm C-112
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rabbit R-18

Meath, county of n.e. Ireland, in Leinster Province; area 903 sq. mi.: pop. 66,337; originally a kingdom with greater territory, which existed until 12th century: *map* I-227

Meat packing M-153–6*b*, *pictures* M-153–6*b*
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Meatus (*mē-ā'tŭs*), **or external auditory canal,** of ear E-170, *pictures* E-170–1

Meaux (*mō*), France, town on Marne River 20 mi. e. of Paris; pop. 13,030; beautiful cathedral begun in 12th century; marked closest approach to Paris of Germans in World War I; farming and milling center.

Mec'ca, holy city of Mohammedans, one of two capitals of Kingdom of Saudi Arabia, near Red Sea; pop. 80,000: M-157, *maps* A-285, A-406–7, *pictures* M-157
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Mechanical brain C-18*a*

Mechanical drawing, or drafting M-157*a–h*, *pictures* M-157*a–h*

Mechanical engineering E-345, 346
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Mechan'ics, branch of physics dealing with the action of force on matter M-158–62, *pictures* M-158–62, *Reference-Outline* P-237
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Newton's contributions N-193–4, planetary motion K-36
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Mechan'icsville, Va., village 7 mi. n.e. of Richmond, where Federals repulsed Confederates in bloody battle June 26, 1862; first of the Seven Days' battles of Peninsular Campaign; also called Beaver Dam Creek: *map* V-487

Mechelen (*mĕκ'ĕ-lĕn*), **or Mechlin** (*mĕk'lĭn*), French **Malines** (*mȧ-lēn'*), Belgium, manufacturing city 14 mi. s. of Antwerp; pop. 60,288; ecclesiastical center; furniture, linens: *maps* B-111, E-424–5

Mechnikov, Ilya. *See in Index* Metchnikov

Mecklenburg (*mĕk'lĕn-bụrκ*), former state in Russian zone, n.e. Germany; area, 8856 sq. mi.; pop. 2,139,640; formed, after World War

II, from former state of Mecklenburg and w Pomerania *maps* G-88, E-424, *table* G-89
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Mecop'tera, order of insects I-160a
Medaille Militaire (*ma-da'yu me-le-têr'*) French military medal D-40
Medal for Merit, U S D-39
Medal of Freedom, U S D 39
Medal of Honor, United States, also called **Congressional Medal** D-38, *color picture* D-41
Medal play, in golf G-136
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Caldecott, *picture* L-268
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decorations of honor D-38–40, *picture* D-39, *color picture* D-41
Newbery *picture* L 267
Olympic Games *picture* O-380
Medan, Sumatra commercial city in n e part of island pop 500,000 *maps* E-202, A-407
Medary, Marjorie (born 1890) author of children's books born Waukon, Iowa, 'Prairie Anchorage' and 'College in Crinoline' are pioneer stories 'Topgallant' is story of a herring gull
Medea (*mē-de'a*), in Greek mythology A-338
Medellin (*mā-dĕl-yen'*) one of chief cities of Colombia 150 mi n w of Bogotá, pop 355 000, gold- and silver-mining manufacturing coffee and orchid center, University of Antioquia, school of mines C-388, *maps* C-387, S-252
Medes (*medz*), ancient Indo-European people of Caspian region M-163
conquer Nineveh N-239, B-9
land where they lived *map* B-6
Persians and P-155
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Medfly. *See in Index* Mediterranean fruit fly
Medford, Mass suburb 5 mi n w of Boston on Mystic River pop 66 113 Tufts College, Craddock House (1634), one of the oldest buildings in the United States which retains original form *map, inset* M-132
Medford, Ore, city in s w about 22 mi from California line in rich fruit-growing and dairying country, pop 17 305, lumber fruit canning, cement brick tourist center *maps* O-416, U-252
Me'dia, ancient kingdom and country now included in n w Iran (Persia), home of Medes M-163, *map* P-156
Median, in statistics S-385e
Mediation, friendly intervention by a third party (or power when applied to international law) in effort to settle a dispute
industrial L-74, A-295 Federal Mediation and Conciliation Service U-367, A-295
international A-294
Medicago (*mĕd-i-kā'gō*), a genus of herbs of family *Leguminosae* C-360
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Medical Service, U S Army A-379–80
insignia *picture* U-238
Medical Badge D-39
Medici (*mĕd'i-chi,* Italian *ma'de-che*) famous Florentine family M-163, F-148, *pictures* M-163 For individual members *see in Index* under Christian names, as Catherine de' Medici
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Medicine, god of. *See in Index* Aesculapius
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Medicine Bow Mountains, a range of the Rockies in Colorado and Wyoming highest point 12 005 ft *maps* C-402, 408, W-316, 323
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Medicine Hat, Alberta industrial and agricultural center in s e on South Saskatchewan River, pop 16 364, flour coal *maps* C-68, 81
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Medicine man, among savage tribes one who professes to cure disease by sorcery M-164b, M-36, 37
African witch doctor C-434b, *pictures* M 34, 36
Indians North American *color picture* I-97 method of treatment, *picture* I-108b
magic dances directed by D-14b
Medieval period *See in Index* Middle Ages
Medill, Joseph (1823–99) American journalist, born New Brunswick, Canada chief owner and editor *Chicago Tribune,* ardent supporter of antislavery movement, mayor of Chicago 1871–73
Medina (*mĕ-de'na*) **Jose Toribio** (1852–1930), Chilean author and bibliographer; wrote and edited books on Latin-American history and geography L-114
Medina (*me-di'na*), holy city in central Hejaz, Saudi Arabia, 110 mi e of Red Sea, much visited by Mohammedan pilgrims, pop 12,000 *maps* A-285, A-406
Ibn Saud conquers A-290
Mohammed at M-329
Medina Sidonia (*mā-de'na sĕ-dō'nya*) **Don Alonso Perez de Guzman,** 7th **duke of** (1550–1615), Spanish admiral, made commander of the Spanish Armada by Philip II because of his noble rank, his lack of naval training and ability were factors in bringing about defeat of Armada by English in 1588
Mediolanum, ancient city in Italy modern Milan M-247
Mediotar'sal arch, or **transverse arch** of the foot F-226
'Meditations', work by Marcus Aurelius M-94
Mediterra'nean climate C-350, E-429
United States U-302
Mediterranean fever, or **Malta fever,** a fever of bacterial origin, occurs chiefly in Mediterranean region occasionally in tropical America
Mediterranean fruit fly, or **medfly** a destructive insect (*Ceratitis capitata*), attacks fruit nuts and vegetables, yellow, black and white markings F-189
Florida's fight against I-163–4
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Mediterranean subrace, of the Caucasoid race R-23, *chart* R-22
Mediterranean wheat, in U S A-63
Me'dium, in spiritualism S-352
Medium wave, *table* R-30
Medjidie (*me-ge'di-ĕ*), a Turkish silver coin which was worth 20 piasters or a later gold coin which was worth 100 piasters
Med'lar, a tree (*Mespilus germanica*) of the rose family, a native of s Europe and w Asia its fruit resembles a small apple and is good to eat only after it has begun to decay
Medul'la oblonga'ta, part of the intracranial nervous system B-279, *picture* B-281
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Medusa (*mē-dū'sa*), in Greek mythology, one of the Gorgons P-154, *picture* M-475
Pegasus sprang from P-110
Medusa, or **jellyfish** J-333–4, *pictures* J-333
Medway, navigable river in s e England joining Thames at Sheerness near mouth, length 60 mi
Meeker, Ezra (1830–1928), pioneer and author, born Huntsville Ohio, drove an ox team over Oregon Trail to Northwest 1852, returned by ox team at age of 76; for 50 years

a farmer in Washington ('Ox-Team Days').
Meer, Jan van der. *See in Index* Vermeer
Meerschaum (*mēr'shạm*), a claylike mineral used chiefly in the manufacture of pipes M-166
chemical composition M-266
Meerut (*mā'rŭt*), city in Uttar Pradesh state, India, 35 mi. e. of Delhi; pop. 233,183; cotton trade; here Sepoy Rebellion first broke out (1857): *map* A-407
Mees (*mēz*), **Charles Edward Kenneth** (born 1882), American chemist, born England; photograph researcher with Eastman Kodak Co. since 1912, vice-president in charge of research since 1934 ('Photography of Colored Objects'; 'The Theory of the Photographic Process').
Meeting-rail. *See in Index* Architecture, *table* of terms
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television T-54*a*
Meg'adyne, physical unit, one million dynes.
Megaera (*mē-ḡē'rạ*), in Greek mythology, one of Furies F-316
Megaliths, huge blocks of rough-hewn stone used by early peoples in building
Carnac, France, *picture* F-271
Stonehenge S-402, *picture* M-66
Megalopolis (*mĕḡ-ạ-lŏp'ō-lis*), ancient Greek walled city in Peloponnesus; founded by Epaminondas (370 B.C.) as capital of Arcadian confederacy; sacked by Spartans (222 B.C.).
Meg'aphone
Greek device for actors T-112
how it increases sound S-239
Meg'apodes, or **mound birds,** family of Australian birds that do not brood their eggs E-268
Megara (*mĕḡ'ạ-rạ*), in Greek mythology, first wife of Hercules, whom he gave to his friend Iolaus, when he wished to marry the daughter of King Eurytus.
Megara, state and city of ancient Greece w. of Attica; seat of Megarian school of philosophy; today chief town of Megaris district: *map* G-197
Athenians take Salamis from S-233
Megarhyssa, an ichneumon fly I-12
Mège-Mouriès (*mĕzh-mọr-ē'*), **Hippolyte,** French chemist, inventor of oleomargarine O-377
Megiddo (*mē-ḡĭd'ō*), ancient, fortified city in Palestine on border of plain of Esdraelon; mentioned in Amarna letters and frequently in the Bible; said to be origin of word. Armageddon; original walls built before 2000 B.C.: *map* P-45
battle (1479 B.C.). *See in Index* Battles, *table*
Megoliths
Stonehenge, *picture* E-357
Mehadia (*mä-hä'dē-ä*), town in s.w. Rumania, famous for Hercules baths, known to Romans.
Meharistes, French camel police of Sahara.
Mehemet Ali (*mä'hĕ-mĕt ä'lē*) (Mohammed Ali) (1769–1849), governor of Egypt; massacred Mamelukes (1811); conquered Syria, but was compelled by European powers to give it up in 1841; did much to develop Egypt: E-278, S-442*a*
Meighen (*mē'ĕn*), **Arthur** (born 1874), Canadian statesman, born Anderson, Ont.; premier (1920–21, 1926).
Meigs (*mĕgz*), **Cornelia Lynde** (born 1884), author, born Rock Island, Ill.; writer of fantastic and historical adventure stories for young people ('Covered Bridge'; 'Trade Wind'; 'The Wonderful Locomotive'; 'The Willow Whistle'; 'Invincible Louisa', Newbery medal 1934; editor of 'A Critical History of Children's Literature').
Meiji, the name of Mutsuhito's reign. *See in Index* Mutsuhito
Meikle (*mĕk'l*), **Andrew** (1719–1811), Scottish inventor of threshing machine T-124
Meiklejohn (*mĭk'l-ḡŏn*), **Alexander** (born 1872), American educator, born England; professor of philosophy and dean, Brown University 1901–12; president Amherst College 1912–24; professor philosophy and director of experimental college, University of Wisconsin, 1926–38: E-254
Mei Lan-fang (1893–1943?), Chinese actor and dancer D-14*g*
Meilhac (*mē-yȧk'*), **Henri** (1831–97), French dramatist, born Paris; collaborated with Ludovic Halévy on operettas, farces, comedies about foibles of Parisian society; music for operettas was composed by Offenbach ('La Belle Hélène'; 'La Grande Duchesse'; 'Barbe Bleu').
Meinesz, F. A. V. *See in Index* Vening Meinesz, Felix Andries
'Mein Kampf', by Adolf Hitler, first published 1925; translated into many languages: H-385, W-246
Meiosis (*mī-ō'sis*), a figure of speech F-65
Meirelles (*mā-rā'lis*), **Victor** (Victor Meirelles de Lima) (1832–1903), Brazilian painter; famous for historical canvases and panoramas of Rio de Janeiro.
Meissen (*mī'sĕn*), Germany, town situated in Saxony on Elbe River 15 mi. n.w. of Dresden; pop. 48,348; 13th-century cathedral
Meissen ware, or Dresden ware P-397, *picture* P-393
Meissonier (*mē-sŏn-yā'*), **Jean Louis Ernest** (1815–91), French painter; highly realistic historical, military, and genre subjects; one of best miniature painters in France; exceptional attention to details ('Friedland 1807'; 'Les Cuirassiers'; 'Napoleon III at Solferino'; 'The Lute Player'; 'The Sign Painter').
Meistersinger (*mīs'tēr-zĭng-ēr*), "master singer" M-460
'Meistersinger von Nürnberg, Die' (*dē mīs'tēr-zĭng-ēr fŏn nürn'bĕrK*), opera by Wagner O-392, W-2
Meitner (*mīt'nēr*), **Lise** (born 1878), physicist, born Vienna, Austria; codiscoverer with Otto Hahn of protoactinium (1918)
atomic power project, *table* A-464
Meknes (*mĕk-nĕs'*), town in n. French Morocco, on railway between Fez and Rabat; pop. 140,380; walled "old" town has Sultan's summer palace and Mulai Ismail mosque; new town a trade center: *maps* A-167, A-46, *picture* M-394
Mekong (*mā-kŏng'*) **River,** in s.e. Asia; rises in Tibet, flows 2600 mi. into China Sea; forms great part of boundary between Siam and Indo-China; also called Cambodia River: *maps* I-123, A-407, 411–12
length, comparative. *See in Index* Rivers, *table*
Melac'onite, a blackish ore of copper occurring in Lake Superior district and Mississippi Valley; known chemically as cupric oxide: C-475
Melanchthon (*mē-lăngk'thŏn*), **Philipp** (1497–1560), German religious reformer, friend and ally of Luther, and through his broad-minded tolerance, learning, and clear thought, the peacemaker and scribe of the Protestant Reformation: R-92
Melane'sia, division of Pacific Islands P-3, 4, *map* P-16–17
Melanesians P-3–4
East Indies E-204–5
New Guinea N-142
racial classification, *chart* R-22
Mel'anism, an excess of black pigment in the skin or in plumage or pelage; opposite of, and less frequent than, albinism.
Melba, Nellie (Nellie Porter Mitchell) (1861?–1931), world-famous Australian prima donna; debut at age of six at Melbourne, city from which she took her name; exceptionally pure and flexible coloratura soprano voice; fascinating personality (Lucia; Gilda in 'Rigoletto'; Elsa in 'Lohengrin'; Michaela in 'Carmen'; Marguerite in 'Faust')
as Marguerite, *picture* O-392
Melbourne (*mĕl'bŭrn*), **William Lamb, Viscount** (1779–1848), English statesman, premier 1834, 1835–41; Queen Victoria's first guide and mentor in statecraft: V-469, 470
quoted on Macaulay M-2
Melbourne, capital of Victoria, Australia; pop. 1,226,923: M-166–7, *map, inset* A-489, *picture* M-167
National Gallery of Victoria. *See in Index* Museums, *table*
Melcher, Frederic G. (born 1879), editor, born Malden, Mass.; co-editor *The Publishers' Weekly* after 1918; president R. R. Bowker Co.
Newbery and Caldecott literary awards L-267, *pictures* L-267–8. *See also in Index* Awards, *table*
Melchers, Gari (1860–1932), genre, mural, and portrait painter, born Detroit; lived most of life in Europe; fine interpreter of motherhood and of peasant types
pioneer woman, *picture* P-261
Melchett, Alfred Moritz Mond, first **Baron** (1868–1930), British statesman and businessman; minister of health; chairman, Economic Board for Palestine.
Melchior (*mĕl'kĭ-ŏr*), one of the Wise Men of the East. *See in Index* Magi
Melchior, Johann Peter (1742–1825), German sculptor, art critic, and potter, born Lintorf, Rhine Province, Germany P-397
Melchior, Lauritz (born 1890), Danish tenor; debut with Copenhagen Royal Opera, 1913; famous for his Wagnerian roles at Bayreuth Festival and with Metropolitan Opera, New York City; also concert, radio, and motion-picture star.
Melchisedek (*mĕl-kĭz'ē-dek*), in Bible, king of Salem and priest of God, who blessed Abraham (Gen. xiv, 18). Jesus is called a priest "after the order of Melchisedek" (Heb. vii, 1-21).
Meleager (*mĕl-ē-ā'ḡēr*), Greek writer and collector of epigrams; compiled, about 60 B.C., a collection of his own and others' writings to form the first 'Greek Anthology'.
Meleager, in Greek mythology, a famous hero, son of Oeneus, the Calydonian king; took part in the expedition of the Argonauts; killed the giant boar of Calydon.
Melegnano, Italy. *See in Index* Marignano
Meleguetta pepper, or **grains of paradise,** a spice made from the seeds of plants of genus *Amomum.*
Meliaceae (*mē-lĭ-ā'sē-ē*), plant family T-185
Melibeus and Prudence, in Chaucer's 'Canterbury Tales' C-203
Melilla (*mā-lēl'yä*), Spanish fortified

MELTING POINTS OF COMMONLY USED MATERIALS*

	FAHRENHEIT	CENTIGRADE
Metals		
Aluminum	1219 36	659 7
Copper	1981 4	1083 0
Gold	1944 32	1062 4
Iron	2795 0	1535 0
Lead	621 32	327 4
Magnesium	1203 8	651 0
Mercury	−37 97	−38 87
Nickel	2651 0	1455 0
Platinum	3224 3	1773 5
Silver	1760 9	960 5
Tin	449 4	231 89
Titanium	3272 0	1800 0
Tungsten	6098 0	3370 0
Zinc . . .	787 05	419 47
Alloys		
Babbitt metal	464 0	240 0
Solder	527 0	275 0
Steel		
High-speed tool	2695 0	1479 4
Structural (carbon)	2765 0	1518 33
Alloys—*Continued*		
Type metal (87% lead 13% antimony)	478 0	247 78
Woods metal	158 0	70 0
Nonmetallic Substances		
Alcohol (ethyl)	−178 6	−117 0
Salt (sodium chloride)	1479 2	804 0
Sugar (sucrose)	320 0	160 0
Sulfur (alpha rhombic)	235 04	112 8
Water (pure)	32 0	0
Amorphous Substances		
(No fixed melting point soften and melt through a range of temperatures)		
Glass		
Quartz (pyre)	1472 0	800 0
Window	1337 0	725 0
Limestone (calcium carbonate)	878 0	470 0

*Equals freezing point in solidification

station and penal settlement on n coast of Spanish Morocco, pop about 94,000 M-393, *map* A-167
Melilo'tus, a genus of herbs of family *Leguminosae*, the sweet clovers C-360
Mel'inite, a high shell explosive chiefly picric acid
Melipo'nes, stingless social bees B-99
Mélisande *See in Index* Pelléas et Mélisande'
Melissa. *See in Index* Balm
Melkarth, name for Baal B-1
Mellette, Arthur Calvin (1842–96), political leader, born Henry County Ind , as member Indiana state legislature 1871, credited with laying foundations of township school system, last territorial governor of Dakota, appointed 1889, first governor of South Dakota
Mellon, Andrew William (1855–1937) financier, born Pittsburgh Pa prominent in industrial development of Pittsburgh with brother founded Mellon Institute of Industrial Research, as secretary of treasury under Presidents Harding, Coolidge and Hoover had part in funding of war debts and management of national debt; U S ambassador to England 1932–33, in 1937 presented $50 000 000 art collection to U S *See also in Index* National Gallery of Art
Mellon, Richard Beatty (1858–1933) banker, born Pittsburgh Pa brother of Andrew Mellon president Mellon National Bank
Melloni, Macedonio (1798–1854), Italian physicist, born Parma, Italy pointed out that heat like light is reflected, refracted, and polarized, studied transparency of substances to infrared radiation and coined word "diathermancy" to designate this property
Mellon Institute of Industrial Research, founded at University of Pittsburgh by Andrew W Mellon and his brother to make scientific research available to industry.
Mellophone, a musical instrument H-427, *picture* M-471
Melo'deon, an American reed organ its reeds are sounded by an inward air current produced by exhaust bellows, about 1850 supplanted the English harmonium, whose reeds are sounded by an outward current from compression bellows
Melodic minor scale, in music M-469
Melodrama, from two Greek words meaning song and drama A-400*n*
Melody, in music M-468*a* *See also in Index* Music, *table* of musical terms and forms
Melon M-167–8, *pictures* M-167–8
seed stored in pulp *picture* N-47
when and how to plant *table* G-19
Meloria, battle of (1284) P-273
Melos (*me'los*), formerly **Milo**, mountainous Greek island 75 mi e of s Greece, 52 sq mi , exports sulfur manganese, 'Venus de Milo' found here in 1820 *maps* G-189, 197
Melos, Venus of *See in Index* 'Venus de Milo'
Melozzo da Forlì (*ma-lôt'so da fôr-lē'*) (1438–94) Italian artist of early Umbrian school, one of first to create illusion of unbounded space (vault of Santi Apostoli in Rome)
Melpomene (*mĕl-pom'e ne*), in Greek mythology, Muse of tragedy M-454
Melrose, Mass residential suburb 8 mi n of Boston, pop 26 988, Boston baked beans, settled 1632 *map, inset* M-132
Melrose Abbey, Scotland in town of Melrose 32 mi s e of Edinburgh S-63*b*, *picture* M-354
heart of Bruce buried at B-332
Melrose Park, Ill , residential and industrial suburb w of Chicago, pop 13 366 railroad shops, steel manufactures, farm machinery *map, inset* I-36
Meltemi, an etesian wind W-150
Melting point, of solids F-283, M-142*b*, W-63, *table* F-284 *See also in Index table* on this page
low melting point alloys A-173, *table* A-174
"Melting pot" (U S) A-197
Melton, James (born 1904), tenor (radio opera and television), born in Moultrie Ga , operatic debut, Cincinnati Zoo Opera, 1938, became member of Metropolitan Opera Co New York City, 1942
Melton, a thick smooth heavy woolen fabric used for overcoats, named from Melton Mowbray (pop 11-052), a fox-hunting resort in England
Melun (*mŭ-lŭn'*) France manufacturing and railroad center on island and on both banks of Seine River 28 mi s e of Paris, pop 15,128 *map* E-425
Melungeons (*me-lŭn'gŭns*) or **Malungeons**, a people of mixed blood (Indian and white, especially Portuguese, and sometimes Negro) living in remote mountain regions of n e Tennessee and w Virginia, typically with dark skin, high cheek bones, and straight or curly black hair, uneducated, often illiterate, name probably derived from French *mélange* ("mixture")
Melusina (*mel-ū-se'nạ*), or **Mélusine** (*mā-lu-zen'*) in French legend a beautiful fairy who was changed every Saturday into a fish or serpent from the waist down, upon being observed in this form she disappeared and wandered thenceforward as a ghost
Melville, George W. (1841–1912) American admiral, scientist and polar explorer; member of Jeannette polar expedition (commanded by De Long) and commander of survivors member of Greely relief expedition engineer in chief of the Navy 1887–1903
Melville, Herman (1819–91), American writer M-168–9, A-227, 228, N-311, *picture* M-168
illustration of 'Moby-Dick', *picture* W-111
Melville Island, Australia, off center of n shore, 2400 sq mi , densely wooded, especially with eucalyptus trees *map* A-488
Melville Island, uninhabited Canadian island of Arctic regions n of Victoria Island, 20,000 sq mi · *maps* C-68, N-250
Melville Peninsula, Canada, 400 mi n of Hudson Bay between Gulf of Boothia and Foxe Channel, 25,000 sq mi *map* C-69
Membrane, a covering lining, or separating layer of tissue Cell membrane separates cell protoplasm from surrounding medium or from other cells In animal body, fibrous membrane, with parallel fibers, provides attachments or support Serous membrane with smooth surface lines or covers organs to prevent binding and friction Mucous membrane lines organs directly or indirectly open to the air, its glands and cells secrete a protective and lubricating fluid the mucus
Memel (*ma'mĕl*), Lithuanian **Klaipeda** or **Klaypeda, Territory**, in n w Lithuanian S S R along Niemen River to Baltic Sea; area 1099 sq mi ; pop 152 000 chief city Klaipeda or Klaypeda (Memel) fortified Baltic port, pop 48 545 Territory taken from Germany by Peace Conference, 1919, given to Lithuania, 1924, as outlet to sea ceded to Germany, 1939, with free port zone for Lithuania, to Lithuania (Lithuanian S S R) in 1945 *map* R-266
Memel River, in White Russian S S R and Lithuania *See in Index* Neman River
Mem'ling, or **Memlinc, Hans** (1430?–94), Flemish painter of portraits and religious subjects exquisite color and modeling and lifelike expression (paintings for shrine of St Ursula at Bruges Belgium 'Marriage of St Catharine', 'Christ, the Light of the World)
'Madonna and Child with Angels' P-25*b*, *color picture* P-25*c*
'Tomasso Portinari', *picture* A-400*b*
Memminger (*mĕm'in-gẽr*), **Christopher Gustavus** (1803–88), lawyer and political leader, born Württem-

berg, Germany; came to U.S. as child; secretary of the treasury Confederate States of America 1861–64.
Mem'non, in Greek mythology, son of Eos and king of Ethiopians M-169
Memnon, Colossi of M-169, E-280
'Memorabil'ia' of Xenophon X-327
Memo'rial Day M-169, F-56–7, *picture* M-169
Memorial rose R-232
Mem'ory M-170
 association M-170
 hypnotism and H-461–2
 memorizing M-170, L-145–6
 recall M-170: in writing W-310*b*
 study, place in S-433–4
Mem'phis, early capital of Egypt at apex of Nile delta s. of Cairo, now in ruins E-279, *maps* B-6, P-156, E-271
 cemetery E-284
Memphis, Tenn., largest city of state; pop. 396,000: M-171, *maps* T-66, U-253, *picture* T-57
 La Salle builds fort T-59
Memphis State College, at Memphis, Tenn.; state control; founded 1912; arts and sciences, business administration, education; graduate school.
Memphremagog (*mĕm-frē-mā'gŏg*), Lake, in s. Quebec province and n. Vermont; 1 to 4 mi. wide and 30 mi. long: *maps* N-144, V-457
Menado, n.e. Celebes. *See in Index* Manado
Menai (*mĕn'ī*) **Strait**, narrow channel (spanned by bridge) separating island of Anglesey from Wales.
Menam (*mā-näm'*) **River**, chief river of Thailand (Siam), flowing s. from Burma 750 mi. and entering Gulf of Siam by several mouths: S-169, *map* I-123
Menan'der (342–291? B.C.), Greek dramatist D-131
Menangkabau, the most advanced of Malay peoples, living in mountains of central Sumatra; believed to be first conquerors of island.
Ménard (*mā-när'*), **René** (1605–61), Jesuit missionary in upper Great Lakes region; born Paris, France; suffered brutal treatment by Iroquois and Ottawa; lost life when going to aid starving, fugitive Hurons in Wisconsin near Lake Superior border: G-185
Menasha, Wis., city on Lake Winnebago, 5 mi. s. of Appleton; pop. 12,385; woodenware, printing and publishing, paper: *map* W-173
Men-at-arms, medieval soldiers W-9
Mencius (*mĕn'shŭs*), or **Meng-tse** (372?–289? B.C.), Chinese philosopher and follower of Confucius; taught that man is by nature good, that government should exist for the people, that war is unjust and unnecessary ('The Book of Mencius')
 Four Books C-276
Menck'en, Henry Louis (born 1880), editor, critic, and essayist, born Baltimore, Md.; journalist at 19; noted for sharp, satirical criticisms of American customs and ideals; editor of *The Smart Set* 1914–23, and of *The American Mercury* 1924–33 ('Prejudices'; 'In Defense of Women'; 'The American Language'; 'The Days of H. L. Mencken', autobiography).
Men'del, Gregor (1822–84), Austrian priest and biologist, abbot of Brünn
 heredity, experiments and laws H-344, B-151, E-452, *diagram* H-345
Mendeléev (*mĕnd-yĕ-lā'ĕf*), **Dmitri Ivanovitch** (1834–1907), Russian chemist, *picture* C-220
 Periodic Table P-150, C-222
Mendelsohn, Eric (1887–1953), architect, born Germany; became English citizen 1938; moved to U.S. 1941; identified with modern movement ('Architecture and the Changing Civilization').
Mendelssohn (Mendelssohn-Bartholdy) (*mĕn'dĕls-sōn bär-tŏl'dē*), **Felix** (1809–47), German musician and composer M-171, M-464, *picture* M-161
Mendelssohn, Moses (1729–86), German (Jewish) philosopher, born Dessau, Prussia; original of Lessing's 'Nathan the Wise', and grandfather of the musician Felix Mendelssohn; one of the founders of the Reform movement in Judaism.
Menderes River, in Asia Minor. *See in Index* Meander River
Mendès (*mäṅ-dĕs'*), **Catulle** (1841–1909), French poet and novelist, one of Parnassian group; a versatile and accomplished writer ('Philoméla', verse; 'Le roi vierge', novel).
Mendès-France, Pierre (born 1907), French political leader, born Paris, France; admitted to bar at 21, elected deputy at 25; imprisoned by Vichy government 1940, escaped 1941 and served with Free French forces; minister of national economy 1944–45; on U.N. Economic and Social Council 1947–50; premier 1954–55: F-274*a*
Mendicant Orders, monastic societies depending upon alms for support M-356
Mendip Hills, England, range 6 mi. wide and 20 mi. long in w. Somersetshire; highest point 1067 ft.; stalactite caves; Roman remains.
Mendocino (*mĕn-dō-sē'nō*), **Cape**, most westerly point of California, *maps* N-250, 245, C-34, U-252
Mendoza (*män-dō'sä*), **Antonio de** (1485–1552), Spanish administrator; first viceroy of New Spain, or Mexico; later viceroy of Peru: S-307, C-45
 Coronado and C-486
Mendoza, Don Pedro de (1487?–1537), Spanish captain, colonizer of Plata River region in Argentina.
Mendoza, Argentina, capital of province of Mendoza, at foot of Andes, 600 mi. n.w. of Buenos Aires; center for trade with Chile; grapes, fruit, wine; pop. 97,496; 10,000 dead in earthquake of 1861: *maps* A-331, S-253
Menelaus (*mĕn-ē-lā'ŭs*), in Greek mythology, king of Sparta, brother of Agamemnon and husband of Helen
 Proteus and P-422
 war against Troy T-190, 192
Men'elik II (1844–1913), emperor of Ethiopia, 1889–1909; able and enlightened ruler; forced recognition of Ethiopian independence from European powers
 war with Italy E-403
Menéndez de Avilés (*mā-nĕn'dāth dā ä-vē-lās'*), **Pedro** (1519–74), Spanish explorer
 Florida coast explored, *map* F-151
 Fort San Mateo captured by F-150
 Georgia claimed by Spain G-79
 St. Augustine founded by S-17
Menes (*mē'nēz*), first of historical kings of Egypt; united Upper and Lower Egypt: E-278*b*
Mengelberg (*mĕng'ĕl-bĕrᴋ*), **Willem** (1871–1951), Dutch orchestral conductor, born Utrecht; conductor Concertgebouw Orchestra, Amsterdam, and of New York Philharmonic Orchestra.
Meng-tse. *See in Index* Mencius
Menha'den, or **pogy**, an oily fish of the herring family F-115, 111
 oyster, enemy of O-438
 young sold as sardines S-44
Menhirs (*mĕn'hērz*), prehistoric monuments S-401
Meninges B-280, 281
Meniscus, in physics L-265
Meniscus lens P-222
Menkaure, or **Mycerinus**, king of Egypt (2525 B.C.)
 pyramid P-446
Menken, Adah Isaacs (1835–68), actress, born New Orleans, La.; began career as ballet dancer; won fame as Mazeppa in play based on Byron's poem.
Men'lo College, at Menlo Park, Calif.; for men; founded 1915; business administration (lower school liberal arts).
Menlo Park, Calif., city 25 mi. s.e. of San Francisco; pop. 13,587; residential; Menlo College and St. Patrick's Seminary: *map, inset* C-34
Menlo Park, N.J., village 14 mi. s.w. of Newark, site of Edison's laboratory E-237, *map* N-164
Menninger (*mĕn'ing-ẽr*), **Karl Augustus** (born 1893) and **William Claire** (born 1899), psychiatrists, brothers, born Topeka, Kan.; with father, **Charles Frederick Menninger** (1862–1953), Karl founded Menninger Clinic, Topeka, 1920, joined by William 1926; since 1945 this clinic has been a part of Menninger Foundation (established 1941 for psychiatric research and training); Karl and William wrote many books and articles on psychiatry and psychoanalysis; Karl one of founders of Winter Veterans Administration Hospital, in Topeka, a psychiatric training center.
Men'nonites, Protestant denomination growing out of Anabaptist movement in 16th century; opposed to oath-taking and military service; hold to simplicity of life and worship and often live in separate communities; named from Menno Simons, leader in Netherlands. For membership, *see in Index* Religion, *table*
 buttons forbidden B-369
 Pennsylvania settlement P-138
Men'no Simons (*sē'mōns*) (1496–1561), Dutch religious reformer, born near Harlingen, Netherlands; founder of later school of Anabaptists in Netherlands, from whom Mennonites took their name.
Meno. *See in Index* Music, *table* of musical terms and forms
Menominee (*mē-nŏm'i-nē*), **Mich.**, city on Green Bay opposite Marinette, Wis., at mouth of Menominee River; pop. 11,151; lumber, furniture, baby carriages: *map* M-226
Menominee, Indian tribe that lives in Wisconsin; name means "wild rice men": *picture* I-100, *table* I-107
 reservation, *picture* W-176
 wigwam, *picture* I-100
Menominee River, formed by union of Michigamie and Bois Brulé rivers on boundary between Wisconsin and upper Michigan; flows s.e. 125 mi. to Green Bay: *maps* M-219, W-172
Menorca (*mā-nôr'kä*), or **Minorca** (*mē-nôr'kä*), 2d largest of Balearic Islands; 260 sq. mi.; fine harbor at Mahón: B-20, *maps* S-312, E-416
Menotti, Gian-Carlo (born 1911), Italian composer of operas and musical plays; came to U. S. 1928; director composition department, Curtis Institute, from 1948 ('Amelia Goes to the Ball'; 'Old Maid and the Thief'; 'The Medium'; 'The Island

God'; 'The Consul'—Pulitzer prize 1950; 'The Saint of Bleeker Street' —Pulitzer prize 1954)
'Amahl and the Night Visitors', *picture* A-400*m*

Mensheviki (*mĕn-shĭv-ē-kē'*), minority of Russian Social Democrats, opposed to Bolshevism.

Mensuration. *See in Index* Measurement

Mental activity
brain and B-282–3

Mental deficiency M-172
heredity M-172, H-343–8, *pictures* H-343, 345–7
measured by intelligence tests I-170–5

Mental hygiene M-172–3
emotion E-340–340*b*, *pictures* E-340–340*b*
U.S. Public Health work H-310

Mental illness
brain and B-283
diagnosing P-427*b*–8
treatment: abnormal psychology P-427*a*; clinical psychology P-427*b*; psychoanalysis P-424*b*–5

Mental tests. *See in Index* Intelligence tests

Mental therapy, or **mind cure** P-427*b*–8, M-164*a*
hypnosis H-462, P-424*b*
psychoanalysis P-424*b*–5

Men'tha, the genus of mint plants M-292

Men'thol, or **mint camphor,** a crystalline substance obtained from essential oils of Japanese mint or peppermint; local applications used for relief of itching or pain.

Mentone (*mĕn-tō'na*), French **Menton** (*măṅ-tôṅ'*), town in s.e. France, on Mediterranean, about 14 mi. n.e. of Nice; pop. 11,079; protected on n. and w. by mountains, it is a favorite winter resort for invalids: *map* E-425

Men'tor, in Greek mythology, friend of Odysseus and guardian of his son Telemachus; hence, a wise counselor.

Menuhin (*mĕn'ū-ĭn*), **Yehudi** (*yŭ-họ'-dĭ*) (born 1916), violinist, born New York City; a child prodigy, made debut at 7 with San Francisco Orchestra; afterward studied in Paris with Enesco; at 11 played with Berlin Philharmonic Orchestra.

Menzel (*mĕnt'sĕl*), **Adolph von** (1815–1905), German artist; famous for series of pictures, 'The Life of Frederick the Great', but best work found in many paintings of daily life; revived art of lithography and wood engraving.

Menzies (*mĕn'zēz*), **Robert Gordon** (born 1894), Australian lawyer and statesman; king's counsel 1929; privy councilor 1937; attorney general, Commonwealth of Australia 1935–39; prime minister 1939–41, 1949–.

Mephistopheles (*mĕf-ĭs-tŏf'ĕ-lēz*), an evil spirit, personification of the devil, in the Faust legends F-45–6, G-130, *picture* O-390

Meramec River, in s.e. Missouri; flows n.e. to Mississippi near St. Louis: *maps* M-312, 319

Merano (*mā-rän'ō*), town in Bolzano province, Italian Tyrol, formerly in Austria; pop. 22,575; noted as health resort: *map* E-425

Merauke (*mē-rou'kĕ*), Dutch New Guinea, seaport on s. coast; pop. 2000: *maps* E-203, P-16

Mercantile system, or **mercantile theory** T-165–6, I-194
American Colonies R-124

Mercantini (*mĕr-kän-tē'nē*), **Luigi** (1821–72), Italian poet, author of 'Garibaldi Hymn'.

Mercator (*mĕr-kā'tĕr*), **Gerhardus,** Latinized form of **Gerhard Kremer** (1512–94), Flemish geographer and map maker; originated "Mercator's projection" of the globe
atlas, name for map collection R-88*g*

Mercator, map projection M-85, 86–7

Mercator-Sanson-Flamsteed, map projection M-86

Merced, Calif., city 65 mi. s.e. of Stockton, in fruit-growing region; pop. 15,278; principal motor and rail gateway to Yosemite National Park; canned fruits, lumber: *map* C-35

Mercedes, Tex., city 24 mi. n.w. of Brownsville; pop. 10,081; citrus fruit and vegetable packing and processing: *map* T-91

Merced River, rises in Sierra Nevada in e.-central California and flows 160 mi. s.w. to Joaquin River, *map* C-34–5
Yosemite Valley Y-341*a*

Mer'cer, John, English inventor of mercerizing process M-173

Mercerizing, process which gives silky finish to cotton M-173

Mercersburg, Pa., borough in s. central part of state; pop. 1613; formerly seat of noted German Reformed church seminary; early home of President Buchanan: *map* P-132

Mercer University, at Macon, Ga.; Baptist; founded 1833; arts and sciences, business administration, Christianity, education, law; graduate studies.

Merchandise Mart, Chicago C-232, *picture* C-233

Merchandising. *See also in Index* Retail trade; Wholesale trade
advertising A-24–5, 26
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chain stores C-181–2
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Merchant Adventurers, Company of R-107–8

Merchant Fleet Corporation, established 1917 as Emergency Fleet Corporation; transferred to U. S. Maritime Commission 1936.

Merchant guild G-228

Merchant marine, commercial vessels as distinguished from the military marine, or navy
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Merchant Marine Academy, United States. *See in Index* United States Merchant Marine Academy

Merchant Marine Act of 1936, U. S. S-159

Merchant Marine Distinguished Service Medal D-39

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'Merchant of Venice', comedy by Shakespeare M-173
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Merchants Exchange, in early New York, *picture* U-376

Merchants of the Staple, R-107–8, E-363

Merchant's tale, in Geoffrey Chaucer's 'Canterbury Tales' C-204

Mercia (*mĕr'shĭ-a*), an Anglo-Saxon kingdom in central England, 6th to 9th centuries; in 8th century was most powerful of all the kingdoms: A-152, *map* E-358

Mercier (*mĕrs-yā'*), **Désiré Joseph, Cardinal** (1851–1926), Belgian prelate and patriot; while professor of philosophy at University of Louvaine, wrote important works on philosophy and psychology; appointed archbishop of Malines 1906; created cardinal 1907; often called the "Voice of Belgium" because of eloquence in opposing Germany's invasion of Belgium in World War I.

Mercier, Honoré (1840–94), Canadian lawyer and statesman; became leader of Liberal party 1883; premier and attorney general 1887; extremely popular in his native province of Quebec until 1891 when charges of corruption (of which he was acquitted) were brought against him in connection with railway subsidies.

"Merciless Parliament," of Richard II R-151

Mercu'ric chloride, bichloride of mercury, or **corrosive sublimate** M-174
antidote F-96*a*
poisoning P-340

Mercurochrome, an antiseptic made by combining fluorescein, an aniline dye of strong penetrating power, with mercury, which has great bactericidal properties.

Mercu'rous chloride (calomel) M-174

Mercury, or **Mercurius,** in Roman mythology. *See in Index* Hermes

Mercury, a planet P-282, *diagrams* P-282–3, *table* P-283
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Mercury, or **quicksilver,** called in Latin and chemistry hydrargyrum (hence chemical symbol Hg), a fluid metallic element M-173–4, *tables* P-151, M-176, C-211, 214
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vapor M-174: electric signs E-314; lamps E-311, Q-3; pumps, to create vacuum V-434
weight M-173

Mercutio (*mĕr-kū'shĭ-ō*), in Shakespeare's 'Romeo and Juliet', witty friend of Romeo.

Mercy, Sisters of. *See in Index* Sisters of Mercy

Mercy College, at Detroit, Mich.; Roman Catholic; for women; incorporated 1941; arts and sciences, education, home economics, medical and radiological technology, nursing, religion.

Mercyhurst College, at Erie, Pa.; Roman Catholic; for women; founded 1926; arts and sciences, fine arts.

Mer'edith, George (1828–1909), English novelist and poet, one of great

masters of Victorian Age; 'The Egoist', his masterpiece, analytical and subtle; 'The Ordeal of Richard Feverel', easier reading, containing some of his most beautiful passages; 'Diana of the Crossways', his greatest popular success; 'Adventures of Harry Richmond', a romantic novel: E-381

Meredith, Owen. *See in Index* Lytton, Edward Robert, earl of

Meredith, Sir William Ralph (1840–1923), Canadian statesman and jurist; did notable work as legislator, particularly on workingmen's laws; served as senator, chief justice of Ontario, chancellor of University of Toronto.

Meredith College, at Raleigh, N.C.; Baptist; for women; founded 1891; arts and sciences, music.

Meres (*mērz*), **Francis** (1565–1647), English author and clergyman, born Lincolnshire; 1598 published 'Paladis Tamia: Wit's Treasury', a review of literary work from Chaucer to his own day
praises Shakespeare S-120

Merezhkovsky (*mĕr-ĕsh-kôf'skē*), **Dmitri Sergeievich** (1865–1941), Russian author of historical novels, born St. Petersburg (now Leningrad); 'Romance of Leonardo da Vinci', one of a trilogy titled 'Christ and Antichrist', about struggle between Christianity and paganism.

Merganser (*mẽr-găn'sẽr*), a duck; species include hooded (*Lophodytes cucullatus*), American (*Mergus americanus*), and red-breasted (*Mergus serrator*); also called sawbill, sheldrake, and goosander: D-161, *picture* D-161

Mergenthaler (*mĕr'gĕn-tä-lẽr*), **Ottmar** (1854–99), American inventor of the Linotype, born Germany; came to the U.S. 1872: L-257, I-201
Linotype patented, *table* I-199

Mérida (*mä'rē-dä*), **Carlos** (born 1893), artist, born Guatemala; moved to Mexico 1919 and became identified with Mexican modern art movement; called "representative of Mexican abstract painting."

Mérida (*mä'rē-thä*) (ancient **Augusta Emerita**), a town in s.w. Spain; pop. 18,089; important in Roman times and under Moors; ruins include a stone-arched bridge crossing the Guadiana, a wall, triumphal arch, and circus: *map* E-425
Roman theater, *picture* S-322

Mérida, capital of Yucatán, Mexico, 23 mi. s. of its port, Progreso, on Gulf of Mexico; pop. 144,793; manufacture and export of henequen: Y-345, *maps* M-189, 195, Y-345

Mérida, Cordillera de, branch of Andes in w. Venezuela V-441, *map* V-442

Mer'iden, Conn., city 18 mi. n. of New Haven; pop. 44,088; noted for silver-plated ware; also manufactures electric fixtures, hardware, automobile accessories, decorated glass: *map* C-444

Merid'ian, Miss., 2d city of state, 90 mi. e. of Jackson in agricultural and lumbering region; pop. 41,893; cotton products, lumber; railroad shops; Meridian Municipal Junior College: *maps* M-303, U-253

Meridian, in astronomy, the vertical circle which passes through the poles of the celestial sphere and the zenith of any given place on the earth's surface: A-438–9

Meridian, or transit, telescope O-325

Meridians, of longitude L-132–5, L-311, *diagrams* E-176, L-132–4, *table* L-135
prime meridian L-133
use in finding directions D-96–9

Mérimée (*mā-rē-mā'*), **Prosper** (1803–70), French novelist, historian, and critic, great master of style ('Chronique du règne de Charles IX'; 'Carmen'; 'Colomba'; 'Mateo Falcone'; 'Lettres à une inconnue'): F-288

Merino, a breed of sheep S-137–8, A-63, *pictures* S-137, A-483
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Merit, Legion of, U. S. D-38

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Merit, Order for, Germany D-40

Merit, Order of, England D-43

Meriwether Lewis National Monument, Tennessee N-36, *map* N-18

Merle d'Aubigne (*mĕrl dō-bē-nyā'*), **Jean Henri** (1794–1872), Swiss Protestant preacher, known for his history of the Reformation.

Merlin, legendary bard, magician, and counselor of Arthurian romance; born of a human mother and a spirit father, from whom he inherited his supernatural abilities; aided kings of Britain, especially Arthur, by means of his magic art; through the treachery of Viviane, the Lady of the Lake, to whom he taught his magic, he disappeared and lived in an enchanted tower in the forest of Brécéliande: A-393, R-236

Mer'maid M-174

Mermaids' purses S-190

Mermaid Tavern, famous old London tavern J-363, S-120

Mer'man M-174

Merope (*mĕr'ō-pē*), daughter of Atlas and wife of Sisyphus of Corinth; she is represented as the seventh and least visible of the stars of the Pleiades because she was ashamed of having married a mortal.

Merovingians (*mĕr-ō-vĭn'gĭ-ănz*), Frankish royal line, founded by Clovis (ruled A.D. 481–511); last of line was Childeric III (ruled 743–751): F-268

Merozoite (*mĕr-ō-zō'ĭt*), a spore formed from the segments that break away from certain kinds of sporozoa, such as those found in malaria parasites M-401

Merriam, Clinton Hart (1855–1942), naturalist, born New York City; chief of United States Biological Survey 1885–1910; author of books on natural history, Indians, Indian legends.

Merriam, John Campbell (1869–1945), paleontologist, born Hopkinton, Iowa; professor University of California; president Carnegie Institution 1920–38 ('The Living Past').

Mer'rick, Leonard (1864–1939), English writer, best known for novels and short stories; also wrote plays ('Conrad in Quest of His Youth'; 'Cynthia'; 'The Actor-Manager').

Merrilies (*mĕr'ĭ-lēz*), **Meg,** a gypsy woman in Scott's 'Guy Mannering' who helped young Harry Bertram, kidnaped in childhood, to regain his rightful property: S-69

'Mer'rimac', Confederate ironclad warship in Civil War M-346–7, *picture* C-337

Merrimack River, rises in White Mountains of New Hampshire and flows s. through Massachusetts into Atlantic at Newburyport: *maps* N-144, M-124
water power N-144: Lawrence L-140–1; Lowell L-338

Mer'ritt, Wesley (1834–1910), Army officer, born New York City; graduated from West Point 1860, distinguished himself as cavalry commander in Shenandoah Valley and in Richmond campaigns, and rose to rank of major general of volunteers; May 1898 commanded U.S. troops in Philippines and was first military governor of the islands; retired 1900.

Merritt, William Hamilton (1793–1862), Canadian statesman, born Bedford, N. Y.; founded St. Catharines, Ont., and promoted building of Welland Ship Canal; president of Executive Council of Canada 1848–50.

Merritt, Lake, Calif., situated in the center of Oakland, and connected by narrow inlet with San Francisco Bay; a popular resort.

Merritt Parkway, in Connecticut C-438, *picture* C-443

Merry del Val (*mĕr'ē dĕl väl*), **Raphael Cardinal,** (1865–1930), Roman Catholic prelate, born in London, England, of Spanish parents; papal secretary of state under Pius X ('Truth of the Papal Claims').

Merry-go-round, French name **carrousel** (*kăr'ụ-zĕl* or *kăr'ụ-sĕl*) C-126, *picture* C-125
play equipment, *picture* P-318

Merryman case T-10

Merry Mount, settlement made by Thomas Morton and others within present Quincy, Mass. (1625); dispersed by disapproving Plymouth Puritans.

'Merry Widow, The', light opera by Franz Lehar, *picture* O-396

'Merry Wives of Windsor, The', rollicking farce by Shakespeare, written about 1600; Falstaff makes love to merry wives, Mrs. Ford and Mrs. Page, who make a dupe of him; secondary love plot that of Anne Page and Fenton
chronology and rank S-129

Mer'sen, Treaty of, agreement in which Charles the Bald of France and Louis of Germany divided Lotharingia, territory left by their nephew Lothair II (870).

Mer'sey, river in n.w. England; flows 70 mi. w. to Irish Sea; wide estuary forms Liverpool harbor: L-277, *maps* B-321, 325
Manchester ship canal H-264
Queensway Road Tunnel (Mersey Tunnel) T-209, L-278

Merten'sia, a genus of smooth or soft-hairy perennial herbs of the borage family with veiny pale-green leaves and loose clusters of attractive purplish-blue flowers; a common species is the Virginia cowslip (*Mertensia virginica*).

Merthyr Tydfil (*mẽr'thẽr tĭd'vĭl*), city in s. Wales on River Taff 22 mi. n.w. of Cardiff; pop. 61,093; chief seat of Welsh iron industry: *map* B-325

Merton, Thomas (Brother M. Louis) (born 1915), American religious (Trappist monk), born Prades, France; entered Abbey of Our Lady of Gethsemane in Kentucky 1941 (autobiographical works: 'The Seven Storey Mountain', 'The Waters of Siloe', 'The Sign of Jonas'; religious writings: 'The Ascent to Truth', 'Bread in the Wilderness').

Merton College, Oxford, England O-434

Merv (*mĕrf*), oasis and ancient city in Turkmen S. S. R., 120 mi. n. of Afghanistan frontier; pop. 50,000: *map* A-406

Merychippus (*mĕr-ĭ-kĭp'ŭs*), ancestor of the horse H-428i

Méryon (*mā-rē-yôn'*), **Charles** (1821–68), French etcher; best known for his etchings of Paris: E-387–8

Mesa (*mā'sä*), Ariz., town 15 mi. s.e. of Phoenix; pop. 16,790; founded 1878 by Mormons; power and water from Roosevelt Dam; cotton gins, fruit packing; Mormon temple: *maps* A-353, U-252

Mesa, a flat-topped ridge E-183, *diagram* E-183
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Mesa'bi Range, Minn., iron-mining region I-238, M-278, *maps* M-278, 286, *picture* I-238
open-pit mine, *picture* M-280
Mesa Verde (*mā'sä vĕr'dä*) (Spanish "green table") **National Park**, in s.w. Colorado C-411, N-36–7, *map* N-18, *pictures* C-347–8
Mescal (*mĕs-käl'*), a liquor A-56
Mescale'ros, tribe of Apache Indians in New Mexico N-181
Mesdag (*mĕs'däĸ*), **Hendrik Willem** (1831–1915), Dutch marine painter, noted for studies of North Sea; gave collection of modern paintings to The Hague.
Mesembryanthemum. *See in Index* Fig marigold
Meshed (*mĕsh'ĕd*) ("place of martyrdom"), Iran, oasis town, capital of province of Khorasan in n.e.; pop. 176,400; silks, carpets, sword blades; shrine of Imam Riza, Shiite leader of 9th century; visited by Mohammedan pilgrims: *maps* A-406, I-224
Mes'mer, Friedrich Anton (1733–1815), Austrian physician; originator of theory of "animal magnetism," or "mesmerism" H-462
Mes'merism H-462
Mesocephaly (*mĕs-ō-sĕf'a-li*) (medium-headedness), in ethnology R-21, *picture* R-23
Mesohip'pus, extinct horselike animal, H-428*i*
Mesolith'ic Age, Middle Stone Age M-69
Mesolongion, Greece. *See in Index* Missolonghi
Meson (*mĕs'ŏn* or *mē'sŏn*) X-332, R-31–2, *table* A-460
bevatron A-462*b*
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Mes'ophytes, plants adapted to moderate conditions of dryness; intermediate between hydrophytes and xerophytes.
Mesopota'mia, region in Asia between Tigris and Euphrates rivers (now included in new kingdom of Iraq): M-174–5, *maps* A-406, P-156, I-224, B-6. *See also in Index* Iraq
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Tigris and Euphrates rivers T-133, E-413
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Mesotho'rium, a radioactive substance midway between radiothorium and thorium, resulting from the disintegration of thorium; used to make luminous paint, especially for clock dials.
Mesozo'ic era, in geology G-59–60, *diagrams* G-52, 58, *table* G-57
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Mesquite (*mĕs-kēt'*), also called **honey mesquite**, a shrub or tree M-175, *picture* M-175
Messager (*mĕ-sä-zhā'*), **André Charles Prosper** (1853–1929), French composer and conductor, born Montluçon, France; director opera in Paris and London
operettas O-396
Messager, Charles. *See in Index* Vildrac, Charles
'Message to Garcia'. *See in Index* García y Iñiguez; Rowan, Andrew S.
Messalina (*mĕs-a-lī'na*), **Valeria** (died A.D. 48), profligate 3d wife of Roman emperor Claudius.
Messana, Latin name for Messina, Sicily, *map* G-197
Messenger, an English thoroughbred stallion imported to America in 1788; chief founder of the Standard-bred Horse: *table* H-428*c*
Messe'nia, state of ancient Greece in s.w. Peloponnesus; cap. Messene: *map* G-197
Sparta conquers G-197
Messi'ah ("the Anointed"), in early Biblical history, one who had been anointed with holy oils and dedicated to some high service; name later used by Jews to signify the promised savior of the world; applied by Christians to Jesus; same as Greek word Christ.
'Messiah', oratorio by George Frederick Handel H-257
Messina (*mĕ-sē'na*), seaport in n.e. Sicily on Strait of Messina between Italy and Sicily; ancient Messana; pop. 218,593: S-176, *maps* I-262, E-416, 425
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Mestrovic (*mĕsh'trō-vich*), **Ivan** (born 1883), Yugoslav sculptor, son of Croatian peasants; art education in Vienna; first exhibition at 19; work shows strength, dramatic intensity (portraits of his mother and of President Masaryk; two equestrian statues of American Indians, in Grant Park, Chicago): S-81
wood carving W-190–190*b*
Metab'olism, term for chemical changes taking place in living cell of plant or animal body, including *anabolism*, building up of more complex substances from simpler ones, and *katabolism*, breaking down of complex substances: B-146
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Metacarpal bone, any one of several bones between the wrist and the fingers S-192, *picture* S-192
Metacenter, in shipbuilding, *picture* S-156
Metacom, or Metacomet. *See in Index* Philip, King
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Metallurgy (*mĕt'al-ûr-ji*), science of extracting metal from ore and refining M-176–7, *table* M-176. *See also in Index* Alloys; and the principal metals by name
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Metamorphosis (Greek, "change of form"), in zoology, transformation of structure during growth. *See also in Index* Larva; Pupa
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Meta (*mä'tä*) **River,** Colombia, rises s. of Bogotá and flows into Orinoco River in n.e. Colombia; 600 mi. long: *maps* C-387, S-252
Metasta'sio, Pietro Bonaventura Trapassi (1698–1782), Italian poet and dramatist, court poet at Vienna 50 years; noted for lyric dramas.
Metatar'sal bone, any of several bones between the ankle and the toes S-192, *picture* S-192
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Metate (*mä-tä'tä*), stone for grinding grain
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Metaurus (*mä-tä'ọ-rọs*), small river in central Italy, emptying into Adriatic Sea
battle (207 B.C.). *See in Index* Battles, *table*
Metaxas (*mĕt-äks-äs'*), **John** (1871–1941), Greek political leader; born on island of Ithaca; chief of staff of army 1915; exiled to Corsica for German sympathies when Greece joined Allies in World War I; led unsuccessful revolt against Venizelos in 1923; with support of king and army set up dictatorship in August 1936: G-194
Metazo'ans, animal group including all many-celled types A-252
Metcalf, Victor Howard (1853–1936), lawyer and Cabinet officer, born Utica, N.Y.; was congressman from California 1899–1904, secretary of commerce and labor 1904–6, and secretary of navy 1906–8.
Metcalf, Willard Leroy (1858–1925), landscape painter, born Lowell, Mass.; painted outdoor light in all its varied gradations; quiet colors of exquisite tone.
Metcalfe, Charles Theophilus, Baron (1785–1846), British statesman, born India; provisional governor general of India 1835; governor of Jamaica 1839–42; governor general of Canada 1843–45.
Metchnikov, or Mechnikov (*mĕch'nĕ-kôf*), **Ilya** (1845–1916), Russian bacteriologist, naturalized in France; originated theory of phagocytosis, that inflammation is due to struggle between white corpuscles and disease germs in the blood; held that sour milk would lengthen life by checking intestinal bacteria; 1908 Nobel prize winner in medicine.
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Meter, fundamental unit of length in metric system (39.37 in.) M-184
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Meter, in music. *See in Index* Music, *table* of musical terms and forms
Meter, in poetry P-335
Meter-kilogram-second (M.K.S.) **system,** scientific and engineering system of measuring motions, forces, and work, using meters for distance, kilograms for mass, and seconds for time.
Meth'ane, or **marsh gas,** an odorless hydrocarbon (CH_4), which forms a methyl radical in chemical combinations. *See also in Index* Firedamp; Paraffin series
chemical formula and actual shape C-211, *diagrams* O-424*a–b*
coal mine danger C-367, 368
illuminating gas contains G-30, 33
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Methanol. *See in Index* Methyl alcohol
Meth'odism, a religious movement. For membership of Methodist bodies, *see in Index* Religion, *table*
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Methodist church, a Protestant organization formed by the union, in 1939, of the Methodist Episcopal church (organized in the U. S. in 1784), the Methodist Episcopal church, South (organized in 1845), and the Methodist Protestant church (organized in 1828). For membership, *see in Index* Religion, *table*
Methodist Youth Fellowship, organization for young people; called Epworth League from its founding (in Cleveland, Ohio) in 1889 until 1941.
Metho'dius, Saint (826?–885). Greek missionary with his brother, Saint Cyril, to Slavs; archbishop of Moravia and Pannonia; festival July 5.
Methu'en, Mass., residential city 26 mi. n. of Boston on Spicket and Merrimack rivers; pop. of township, 24,477: *map* M-133
Methuen Treaty (1703) P-380
Methuselah (*mē-thū'sē-la*), son of Enoch and father of Lamech; Genesis v, 27 assigns him a lifetime of 969 years.
Meth'yl, a chemical radical (CH_3) derived from ethane existing in combinations
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Methyl alcohol, also called **wood alcohol** and **methanol** A-146, O-424*b*
antifreeze for automobile radiators F-284
formula, *diagrams* O-424*a–b*
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synthetic: from corn C-484–5
Methyl chloride, a compound of methyl and chlorine (CH_3Cl)
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Met'ic, a freed slave in Athens G-199
Métis (*mā-tē'*), French-Canadian half-breeds C-99–100, 100–1
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Metlakahtla, or **Metlakatla,** village in s.e. Alaska, 15 mi. s. of Ketchikan; co-operative Indian village, pop. 817; U.S. Army and Navy base: *map* A-135
Meton (*mē'tŏn*), Athenian astronomer, 5th century B.C.; instituted use of Metonic cycle, a period of 19 years, after which new and full moons

fall on same days of year as they did when cycle started.
Meton'ymy, in rhetoric, figure of speech in which one word is used for another to which it bears some close relation, as "the kettle boils," instead of "the water boils." Synecdoche is a form of metonymy.
Metopes (*mĕt'ō-pēz*), in architecture, *picture* A-308
Met'ric system, of weights and measures M-184, W-89, *table* W-88
Metronome, time-beating device M-468*a*
Metropol'itan, an ecclesiastical title in the Christian church, almost equivalent to archbishop; holder has oversight over bishops of subordinate sees; title arose from old custom of giving precedence to bishop of metropolis.
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Houdon's portrait of Benjamin Franklin, *picture* S-78*d*
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Madonna and Child of polychromed oak, *picture* S-73
Michelangelo's 'Studies for the Libyan Sibyl' D-139, *picture* D-140*a*
Monet's 'Sunflowers', *color picture* P-31*c*
Persian painting of Jonah and the whale P-37*a–b*, *color picture* P-37*d*
Raphael's 'Madonna and Child Enthroned with Saints' P-26, *color picture* P-26*a*
Ruben's 'The Wolf and Fox Hunt' P-27*d*, *color picture* P-28
'The Tribute Horse', Chinese P-37*a*, *color picture* P-37*c*
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Turner's 'The Grand Canal, Venice', *color picture* P-29*d*
Unicorn tapestries, *color picture* T-12
Van Ruisdael's 'Wheatfields', *color picture* P-29*b*
Vermeer's 'Young Woman with a Water Jug' P-29*a*, *color picture* P-29*a*
Metropolitan Opera Company, term applied collectively to organizations which have presented operas at Metropolitan Opera House, New York City; official name after 1932 Metropolitan Opera Association, Inc.; first performance Oct. 22, 1883 ('Faust'), first radio broadcast Christmas Eve, 1931 ('Hänsel und Gretel'), first telecast to theaters Dec. 11, 1952 ('Carmen').
Metsu (*mĕt'sü*), **Gabriel** (1630–67), Dutch painter; noted for fair and market scenes and for truthful representation of life in both low and high classes of society ('The Music Lesson'; 'Amsterdam Market')
'The Order', *picture* E-444
Metternich (*mĕt'ẽr-nĭk*), **Clemens, Prince** (1773–1859), Austrian reactionary statesman and diplomat; influence over Congress of Vienna (1814–15) secured preponderance of Austria in European affairs; period of 1815–48 is sometimes called "Age of Metternich": A-498
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Mettur Dam, in Madras state, India, on Cauvery River; irrigates about 1,300,000 acres: I-53. *See also in Index* Dam, *table*
Metz (*mĕts*, French *mĕs*), city of Lorraine; pop. 65,472: M-184, *maps* F-259, E-425
Meulles, Chevalier Jacques de (flourished 1682–86), French statesman, born Poitou, France; intendant of New France 1682–86.
Meunier (*mû-nyā'*), **Constantin** (1831–1905), Belgian sculptor and painter; best known for sculptures portraying men and women at work ('The Hammerer', 'The Sower', 'Monument to Labor'): S-80
Meurthe-et-Moselle (*mûrt-ā-mō-zĕl'*), department of France in region called Lorraine; area, 2038 sq. mi.; pop. 528,805: A-181
Meuse (*mûz*), department of France in region called Lorraine; area, 2408 sq. mi.; pop. 188,786: A-181
Meuse-Argonne (*är-gôn'*), region in France between Verdun and Vouziers extending from Meuse River 25 mi. w. to Aisne River
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Meuse River, in Netherlands called Maas (*mäs*), important river of w. Europe; 560 mi. long: M-185, *maps* B-111, F-259, W-232–3
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Mew (*mū*), **Charlotte Mary** (1869–1928), English poet; work shows understanding, power, and artistry ('The Farmer's Bride'; 'The Rambling Sailor').
Mexica'li, city in Lower California; pop. 64,658: C-49, *map* M-194
Mexican bean beetle. *See in Index* Bean beetle, Mexican
Mexican cigar flower. *See in Index* Cuphea
Mexican grass, a fiber obtained from several species of Mexican agaves; used in brush manufacture.
Mexican grebe (*Colymbus dominicus brachypterus*), a member of the grebe family; range s. Lower California and s. Texas s. to Panama.
Mexican hairless dog, a small dog, *table* D-119
Mexican jumping bean. *See in Index* Jumping bean
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Mexican Plateau, high area in central Mexico, *map* N-245
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Mexican rubber tree. *See in Index* Caucho
Mexican shell flower. *See in Index* Tigridia
Mexican sunflower. *See in Index* Tithonia
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Mexico, a republic of North America; 767,198 sq. mi.; pop. 25,706,182; cap. Mexico City: M-187–209, *maps* M-194–5, 189, N-251, *pictures* M-187–8, 190–2, 197–9, 201–5, 207–8, *Reference-Outline* M-209. *See also in Index* Central America; Latin America
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Mexico, state in s.-central Mexico; 8267 sq. mi.; pop. 1,390,018; cap. Toluca (pop. 41,000): *map* M-195
Mexico, Mo., city 100 mi. n.w. of St. Louis; pop. 11,611; farming area; saddle horses; fire brick; shoes; soybean mill; Missouri Military Academy: *map* M-318
México, D. F., official name of Mexico City; "D. F." stands for *Distrito Federal*, referring to federal district in which city is located: *map, inset* M-195
Mexico, Gulf of, arm of the Atlantic, almost enclosed by U. S., Mexico, and Cuba: G-228*a*, *maps* N-251, 245. *See also in Index* Ocean, *table*
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Meyer (*mī'ēr*), **Adolf** (1866-1950), American psychiatrist, born in Switzerland; to U. S. 1892; became citizen 1901
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Meyer, Conrad Ferdinand (1825-98), Swiss poet and historical novelist: clear, polished style ('Jürg Jenatsch'; 'Thomas à Becket, the Saint').
Meyer, George von Lengerke (1858-1918), statesman, born Boston, Mass.; ambassador to Italy 1900-1905, to Russia 1905-7; postmaster general under President T. Roosevelt; secretary of navy under President Taft.
Meyer, Julius Lothar (1830-95), German chemist, born Varel, Oldenburg; helped to develop periodic law in chemistry.
Meyerbeer (*mī'ēr-bār*, English *mī'-ēr-bēr*), **Giacomo**, real name Jakob Liebmann Beer (1791-1864), German composer of Jewish parentage, born Berlin; accomplished pianist at 9; studied piano with Clementi, counterpoint with Vogler; known for French operas, also wrote in German and Italian styles; collaborated with A. E. Scribe, librettist ('Robert le Diable'; 'Le Prophète'; 'L'Africaine')
'The Huguenots' O-390: historical background H-443
Meyerhold, V. E. (born 1874), Russian actor and stage director D-134
Meynell (*mĕn'ĕl*), **Alice** (1847-1922), English poet and essayist: brought up in Italy; won praise of Ruskin, George Eliot, and Rossetti; rigid restraint, perfection of craftsmanship ('Preludes', 'Renouncement', 'A Father of Women', 'The Rhythm of Life'); daughter Viola Meynell also an able poet and novelist.
Mezereum (*mē-zē'rē-ŭm*) **family**, or **Thymelaeaceae** (*thĭm-ē-lē-ā'sē-ē*), a family of plants, shrubs, and trees; includes spurge flax, leatherwood, rice flower, and the gnidias.
Mézières (*māz-yêr*), France, town 125 mi. n.e. of Paris; pop. 7898; resisted Allies for six weeks after Waterloo 1815; taken by Germans 1871, 1914, and 1940: *map* B-111
Mezokovesd (*mĕ'zû-kû-vĕsht*), Hungary, town 72 mi. n.e. of Budapest; pop. about 21,000; embroideries costumes, *pictures* H-449
Mézy, Augustin de Saffray, chevalier de (died 1665), French political leader appointed governor of New France in 1663 through influence of Bishop Laval-Montmorency, but later rebelled against the policies of his patron.
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Miami (*mī-ăm'ĭ*), Indian tribe that formerly lived in Wisconsin, Michigan, Illinois, Indiana, and Ohio, *map* I-106*f*, *table* I-107
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Miami, Ariz., coppermining town and cattle market in Pinal Mts. 7 mi. from Globe; pop. 4329: *map* A-353
Miami, Fla., in s.e. on Biscayne Bay; pop. 249,276; famous winter resort; shipping point for fruit and vegetables: M-211, *maps* F-159, U-253, *pictures* M-211, F-161
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Overseas Highway K-37
Miami, Okla., city in n.e.; pop. 11,801; lead and zinc mining, farming and livestock interests: *map* O-371
Miami, University of, at Coral Gables, Fla.; founded 1926; arts and sciences, business administration, education, engineering, law, music; graduate school.
Miami and Erie Canal, name given in 1849 to the three canals previously known as Miami Canal, Miami Extension Canal, and Wabash and Erie Canal; these canals gave Ohio a water route from Cincinnati to Toledo: *map* C-108
Miami Beach, Fla., island city off s.e. coast; pop. 46,282; popular winter resort: M-211, *maps* F-159, U-253, *pictures* U-283, F-161
Miami River, also called **Great Miami River**, rises in w. center of Ohio, flows s. to Ohio River; 160 mi. long: *maps* O-348, 356-7
Dayton flood D-25
Miami University, at Oxford, Ohio; state control; founded 1809; arts and science, business administration, education, fine arts; graduate school
honors courses U-403
Miantonomo (*mī-ăn-tō-nō'mō*) (1565?-1643), Narraganset Indian chief; condemned to death by whites for waging war against Uncas in spite of treaty; killed by brother of Uncas; monument near Norwich, Conn.
Miaskovsky (*mē-yăs-kôf'skē*), **Nicola Yakovlevitch** (1881-1950), Russian composer, born Novogeorgievski; pupil of Rimsky-Korsakov; professor composition, Moscow Conservatory; wrote symphonies and symphonic poems, generally melancholy in tone, string quartets, piano music, and songs.
Mica, any of several transparent silicate minerals which split into sheets M-211, M-266
black mica, or biotite M-266, R-169
cleavage M-261
electric insulating properties E-297, 298: condensers use E-306
granite contains G-151
Micah (*mī'kȧ*) (about 757-700 B.C.), one of Hebrew minor prophets, contemporary of Isaiah; author of 33d book of Old Testament.
Micarta, a synthetic plastic C-371
Mica schist, a metamorphic rock composed chiefly of mica and quartz; divides readily into slabs.
Micaw'ber, Wilkins, in Charles Dickens' 'David Copperfield', an unpractical optimist who is always

waiting for "something to turn up": D-84, N-311
Mice. *See in Index* Mouse
Michael (*mī'kĕl*), archangel, leader of celestial armies (Rev. xii, 7); festival Sept. 29.
Michael (1596–1645), czar of Russia, first of Romanov line R-285
Michael V, or **Mihai** (*mē-hī'*) (born 1921), king of Rumania; in 1927 succeeded his grandfather, Ferdinand I, as King Michael I, his father, Carol II, having given up rights to throne; government in hand of regency during Michael's reign which lasted until his father's return to throne in 1930; again became king 1940 when his father abdicated; abdicated 1947: R-254
Michael Angelo Titmarsh, pen name of William Makepeace Thackery T-108
Michaelmas, the feast of St. Michael, September 29.
Michaelmas daisy, or **Christmas daisy**, a species of aster A-426
Michael Obrenovitch (*ō-brĕn'ō-vĭch*) **III** (1823–68), prince of Serbia; succeeded 1840, deposed 1842, restored 1860; secured withdrawal of Turkish troops from Serbia; assassinated by Karageorgevitch supporters.
Michel Accault. *See in Index* Aco, or Accault, Michel
Michel (*mē-shĕl'*), **Claude**, called Clodion (*klōd-yôn'*) (1738–1814), French sculptor, favored by Louis XV for whom he did portrait statues; noted for nymphs, fauns, and bacchantes.
Michelangelo (*mī-kĕl-ăn'ğĕ-lō*, Italian *mē-kĕl-ăn'gä-lō*) **Buonarroti** (*bwō-năr-rō'tē*) (1475–1564), Italian sculptor, painter, architect, and poet M-212–14, S-78c, P-27
'Bound Slave', *picture* S-78b
'David', statue M-213, I-280
'Dawn and Dusk', sculpture, *picture* M-214
dome of St. Peter's church M-214
drawing D-139, *picture* D-140a
'Holy Family', painting, *picture* M-213
'Madonna della Pietà' M-213, *picture* M-213
'Moses', statue M-214, S-78c, *picture* M-212
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'Virgin and Child', sculpture, *picture* M-214
Michelet (*mĕsh-lĕ'*), **Jules** (1798–1874), French historian, learned and interesting, but partisan and uncritical ('Histoire de France').
Michelson, Albert Abraham (1852–1931), American physicist M-215, *pictures* M-215, P-236
earth's rigidity, evidence of E-193
other drift experiment M-215, R-98, 99, *picture* M-215
interferometer L-233–4; light speed measured by M-215, *diagram* L-230
star diameters measured S-373
Michelson-Morley experiment, on ether drift M-215, R-98, 99
Michener (*mĭtch'ĕn-ẽr*), **James A(lbert)** (born 1907), author, born New York City; associate editor The Macmillan Co. 1941–49; with U.S. Navy in South Pacific World War II; his 'Tales of the South Pacific' won Pulitzer prize for fiction 1948 and was basis for musical play, 'South Pacific', awarded Pulitzer prize 1950 ('The Fires of Spring', 'The Bridges at Toko-ri', and 'Sayonara', novels).
Michigan (*mĭsh'ĭ-găn*), a n.-central state of U.S.; 58,216 sq. mi.; pop. 6,371,766; cap. Lansing: M-216–30, *maps* M-226–7, 219, 223, U-253, 287, *pictures* M-217–18, 220, 229–30
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Grand Rapids G-151
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sand dunes along shore I-71, *picture* I-83
size, comparative. *See in Index* Lakes, *table*
Michigan, University of, at Ann Arbor, Mich.; state control; chartered 1817, opened 1841; arts and sciences, architecture, business administration, dentistry, education, engineering, law, medicine, music, natural resources, nursing, pharmacy, public health, social work; graduate school
Burton Memorial Tower, *picture* M-230
football history F-231
National Music Camp affiliated B-46a
Michigan Avenue, Chicago, Ill., *map* C-231b, *picture* C-234
Michigan City, Ind., manufacturing city and port at s. end of Lake Michigan 40 mi. e. of Chicago; pop. 28,395; trade in lumber, sand, and iron ore; railroad cars, furniture, iron products, brick, machinery: *map* I-78
Michigan College of Mining and Technology, at Houghton, with branch at Sault Ste. Marie, Mich.; state control; founded 1885; opened 1886; chemical, civil, electrical, geological, mechanical, metallurgical, and mining engineering, engineering administration, engineering physics, chemistry, forestry, mathematics, physics; graduate studies.
Michigan Road, historical road in U.S. R-161, *map* R-159
Michigan State University of Agriculture and Applied Science, at East Lansing, Mich.; state control; chartered 1855; opened 1857; science and arts, agriculture, business and public service; graduate school; first state institution for agricultural education in United States.
Michilimackinac (*mĭk-ĭ-lĭ-măk'ĭ-nạ*), mission station established at St. Ignace, Mich., by Marquette M-229
Michoacán (*mē-chō-ä-kän'*), state in s. Mexico; 23,200 sq. mi.; pop. 1,415,257; cap. Morelia: *map* M-194–5
Mickey Mouse, animated cartoon character, created (1928) by Walt Disney; in France "Michel Souris," in Japan "Miki Kuchi," in Spain "Miguel Ratonocito," in Denmark "Mikkel Mus."
Mickiewicz (*mĕts-kē-yĕ'vĕch*), **Adam** (1798–1855), greatest Polish poet; chiefly famous for epics based on folk tales and legends ('Pan Tadeusz'; 'Dziady'; 'Grazyna').
Micmac (*mĭk'măk*), from Indian word *migmak*, allies, important Algonquian Indian tribe of Nova Scotia and neighboring parts of Canada; became fast friends of French and were only slowly won to friendship with British; their government was similar to that of New England Indians: A-5, N-308, *map* I-106f, *table* I-107
Microbe (*mī'krōb*), popular name for a bacterium D-101–2, B-12. *See also in Index* Bacteria
vaccines made from V-433a, b
Microbiology. *See in Index* Bacteriology
Microchemistry, a technique of chemical research in which very small amounts of material are used under minutely controlled conditions; special equipment is required.
Microcline, a feldspar with triclinic crystals, having three unequal, inclined axes.
Microfarad (*mī'krō-făr-ăd*), in electricity E-306
Microfeeders, in animal kingdom A-250a
Microfilm M-230–1, *pictures* M-231
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libraries P-227, R-194
Microm'eter, an instrument for small measurements M-231, T-154, *pictures* M-231
scale, how to read M-231
Mi'cron, a very small metric unit of length (.0001 centimeter), *table* R-30

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micrometer measures M-231
Micronesia (*mī-krō-nē'shi-a*), a collection of small island groups in Pacific P-3, 4, *map* P-16
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killed by heat in canning F-219, 220, B-14
Microphone, a device in which carbon granules packed behind a diaphragm transform sound waves into changes in electric current
detective dictograph D-89
invented by Edison E-237
motion-picture sound recording M-411, 421–2, *pictures* M-420, 421
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submarine signaling for ships S-179
telephone transmitter, *picture* T-40
termites detected by, *picture* T-75
Micropodidae (*mī-krō-pō'di-dē*), family of birds composed of swifts.
Micropodiformes (*mī-krō-pō-di-fôr'mēz*), an order of insectivorous birds, comprising hummingbirds and swifts; characterized by weak feet and long narrow wings.
Micropyle (*mī'krō-pīl*), in botany F-186
Microscope M-232–6, *pictures* M-232, 234
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Microwave (ultra-high frequency or ultra-short wave length), in radio R-41, T-45, *diagram* E-344*b*, *table* R-30
radar R-25–8, *pictures* R-25–8
Microwave astronomy A-442, R-28
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Midbrain, *picture* B-281
Middelschulte, Wilhelm (1863–1943), organist, born Germany; to U.S. 1891; noted interpreter of Bach.
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water supply W-74
weights and measures W-86–7
windows S-144*a*
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Middle America, Latin America between South America and the United States; includes Central America, West Indies, and Mexico.
Middle Atlantic Region, of U.S., name used by U. S. government for geographic division including states of New York, New Jersey, and Pennsylvania, and sometimes also Delaware and Maryland: U-264–71, *map* U-265, *Reference-Outline* U-336*a*. *See also in Index* United States, *subhead* geographic regions, *also* names of states
Middlebury College, at Middlebury, Vt.; founded 1800; arts and sciences; summer language schools of English, French, German, Italian, Russian, and Spanish; Bread Loaf Writers' Conference.
Middle C, in music M-468
position, *diagram* M-468*b*
Middle Colonies. *See in Index* American Colonies, *subhead* Middle Colonies
Middle Congo, or Moyen Congo, territory in s. French Equatorial Africa; approximately 132,000 sq. mi.; pop. 624,137; cap. Brazzaville: *map* A-46–7
Middle ear, tympanic cavity, or tympanum E-170, S-192, *pictures* E-170–1
Middle East, term for economic and strategic area including Malta, Cyprus, Turkey, Syria, Lebanon, Israel, Jordan, Iraq, Iran, Arabia, the Somalilands, Ethiopia, Eritrea, the Sudan, Egypt, Cyrenaica, and Tripolitania. Not to be confused with Near East.
Middle English E-374
Middle latitudes C-350
Middleman, an agent between the producer and the retail seller
agricultural marketing A-66
food distribution F-214
'Middlemarch', novel by George Eliot; *realistic study of a provincial English town and its people*: E-330
Middlesboro, Ky., resort and trade center w. of Cumberland Gap; pop. 14,482; coal mining, farming; leather, foundry products: *maps* K-31, U-253
Middlesbrough (*mid'lz-brŭ*), seaport and manufacturing city on Tees River in n.e. England; pop. 147,336; iron and coal: *map* B-325
Middlesex, England, inland county forming n.w. part of Greater London; 232 sq. mi.; pop. 2,268,776; ancient county 283 sq. mi., of which 50 sq. mi. are included in administrative county of London: *map* E-347
Middlesex Canal, in Massachusetts, connected Boston with Merrimac (now Merrimack) River, near Lowell: *map* C-108
Middle Stone Age, or Mesolithic Age M-69

Middleton, Arthur (1742–87), signer of Declaration of Independence, born South Carolina, wrote political articles under name Andrew Marvell
signature reproduced D-37

Middleton, Sir Frederick Dobson (1825–98), British soldier, born Belfast, Ireland, commander of Canadian militia 1884–90; in 1885 led expedition to Northwest Territories to suppress Riel Rebellion

Middleton, Thomas (1570?–1627), English dramatist, wrote realistic comedies of London life ('Michaelmas Term', 'Trick to Catch an Old One'), later collaborated with William Rowley in writing tragedies ('A Fair Quarrel', 'The Changeling'), city chronologer of London after 1620

Middletown, Conn, industrial and farming center on Connecticut River 15 mi s of Hartford pop 29,711 typewriters textiles marine engines silverware, Wesleyan University *map* C-445

Middletown, N Y industrial and railroad city, 50 mi n w of New York City, pop 22,586, in gardening, stock-raising and dairying district, saw blades lawn mowers shirts, shoes, important in early days because of location between Hudson and Delaware rivers on old Minisink road *map, inset* N-204

Middletown, Ohio industrial and railroad city on Miami River 28 mi n of Cincinnati, pop 33 695, paper, steel tobacco *map* O-357

Middleweight, in boxing B-267

Middle West, in United States U-284, *Reference-Outline* U-336b–8 *See also in Index* Great Plains, North Central Plains

Middlings, in flour milling F-166–7

Mid'gard, place in Norse mythology M 476c

Midgard serpent, or Midgardsorm, in Norse mythology O-340
Thor and T-122

Midges, a group of flies of the order *Diptera*, family *Chironomidae* mosquitolike in form but more delicate

Midget a diminutive person, *picture* C-312

Midgley, Thomas, Jr. (1889–1944), chemist born Beaver Falls Pa , discovered tetraethyl lead (1922) as an antiknock agent in gasoline, noted also for work on air conditioning rubber and extraction of bromine from sea water

Mid-Hudson Bridge, in New York *See in Index* Bridge *table*

Midi, Canal du, France *See in Index* Canal du Midi

Midianites (*mid'i-ăn its*) ancient Semitic people of North Arabia referred to in the Bible as merchants, warriors and shepherds
Moses in land of Midian M-399

Midiron, a golf club *picture* G-138

Midland, Mich city on Tittabawassee River near Saginaw, pop 11 285, Dow Chemical Co *map* M-227
magnesium M-41

Midland, Ontario, Canada town on Georgian Bay 80 mi n of Toronto, pop 7206 grain elevators lumber and flour mills shipbuilding yards *map* C-72

Midland, Tex, city 102 mi n w of San Angelo pop 21 713, in 1951 was headquarters for some 300 oil companies, Hereford cattle, cotton *map* T-90

Midland College, at Fremont Neb · Lutheran, opened 1887, chartered 1888 arts and sciences

Midlands, the middle counties of England E-348, 350

Midlothian, formerly **Edinburghshire**, county of s e Scotland on Firth of Forth, 366 sq mi , pop 565,746, oats chief crop, cap Edinburgh

Midnight sun, *diagram* A-327, *picture* S-452
Norway N-300
Sweden S-462

Midshipman, in U S Navy, next below a commissioned officer, a student of the Naval Academy, N-70–1, *picture* N-70

Midshipman, or singing fish, a fish (*Porichthys notatus*) of the toad-fish family, common on the coast of California has rows of phosphorescent shining spots like brass buttons makes a peculiar humming noise with its air bladder

Midsummer Day, Scandinavian holiday S-465

'Midsummer Night's Dream' by Shakespeare M-240, *picture* M-240
chronology and rank S-129
Mendelssohn's music to M-464

"Mid-Victorian" V-469

'Midway', aircraft carrier N-83

Midway Islands, atolls belonging to U S , n w of Hawaiian Islands pop 437, midway between Asia and America, discovered 1859 by Capt N C Brooks, U S Navy, annexed 1867 *maps* P-17, A-531
battle (1942) W-261, 286
cable connections C 5

Midwestern University, at Wichita Falls Tex formerly Hardin College (established 1946), arts and sciences, music

Midwife toad T-141

Miehle, Robert (1860–1932), inventor, born Chicago, Ill
Miehle printing press P-414d

Mieris (*me'ris*), **Frans van** (the elder) (1635–81) Dutch genre painter born Leyden, skill in painting rich and colorful fabrics ('Two Ladies Drinking Tea', 'Boy Blowing Soap Bubbles') His sons **Willem** (1662–1747) and **Jan** (*1660–90*), *also* portrait and genre painters

Mies van der Rohe, Ludwig (born 1886), American architect, born Aachen Germany, influenced by Frank Lloyd Wright, director in architecture, Illinois Institute of Technology, Chicago after 1938

Mifflin, Thomas (1744–1800) general and political leader, born Philadelphia Pa , colonel and first aide-de-camp to Washington, leader of unsuccessful "Conway Cabal to remove Washington signed United States Constitution, U S senator, governor of Pennsylvania

Mignon (*men-yon'*), Italian maiden in Goethe s 'Wilhelm Meister s Apprenticeship' who dies for love of Wilhelm subject of opera

'Mignon', opera by Ambroise Thomas story O-392

Mignonette (*min yon-et*), a flowering plant M-240

Mignonette, Jamaica *See in Index* Henna

Mignonette vine *See in Index* Madeira vine

Migration of animals M-241–4, *maps* M-241–3, *picture* M-244
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Migration of people M-245–6, *picture* M-245. *See also in Index* Emigration, Immigration
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Greeks and Moslems uprooted from Turkey and Greece G-193
India I-68b
Jews to Palestine P-46, I-258
Pakistan P-42
World War II M-246, W 257

Migratory labor California C 40
trailer living A-529, *picture* S-144d

Miguel (*me-gel*) **Dom Maria Evaristo** (1802–66) Portuguese prince and pretender, 3d son of John VI whom he tried to dethrone, and uncle of Maria da Gloria, whose throne he usurped occupied throne 1828–33

Mihai *See in Index* Michael V

Mihailovich (*me hi lov ich*), **Draja** (1893?–1946) Yugoslav general born Belgrade Serbia minister of war and chief of staff for Yugoslav government in exile (London) 1942–44, arrested as traitor by Communists 1946 executed Y-347

'Mikado', popular comic opera, book by Sir W S Gilbert lively music by Sir Arthur S Sullivan first produced in London 1885
high-school production *picture* E 250

Mikan (*mi kan*), **George (Lawrence)** (born 1924) basketball player born Joliet Ill played professional basketball with Minneapolis Lakers 1948–54 (autobiography 'Mr Basketball) B-76

Miklas (*mek'las*) **Wilhelm** (born 1872) president of Austria 1928–38 elected to parliament 1907 joined first National Assembly of the Republic 1918 became chairman 1923

Mikoyan (*mink-u-yan'*), **Anastas Ivanovich** (born 1895) Russian government official born Armenia educated for priesthood, became member of Central Committee of Communist party 1922, full member of Politburo 1935, as commissar for food industry visited U S 1936 to study food processing a deputy premier 1937–55 in charge of foreign trade 1938–49, a first deputy premier after 1955

Milam, Ben (1791?–1835), Texan patriot born Kentucky, led capture of San Antonio (1835) in Texas war for independence

Milan (*mē'lan*) **Obrenovitch** (*ō-brĕn'ō vich*) **IV** (1854–1901), prince of Serbia, succeeded 1868 secured Serbian independence and became king 1882 abdicated 1889 in favor of his son Alexander I

Milan (*mi-lăn'* or *mil'an*), Italy Italian **Milano** (*me-la'nō*), city of Italy pop 1,264 402 M-247, *maps* I-262, E-416, 425

cathedral I-278, 279, *pictures* I-277, E-440
'The Last Supper' V-474, *picture* V-473
war of Charles V and Francis I F-275
Milan, Edict of (A.D. 313) C-456
Milanese fabric F-8
Milbank Memorial Fund, established 1905 by Elizabeth Milbank Anderson for advancement of health and social welfare F-249
Mil'dews and molds M-247–8, *picture* M-247
cheese C-206
Mile, a unit of measure, *table* W-87
changing degrees of latitude and longitude into L-134
nautical, *table* W-87: how measured L-294
origin of name W-86
railroad line R-60
Miles, Nelson A. (1839–1925), soldier, born near Westminster, Mass.; fought at Antietam, Fredericksburg, Chancellorsville, the Wilderness, Spotsylvania, and Cold Harbor, and received Congressional Medal of Honor; later famous Indian fighter, captor of Apache chief Geronimo; senior officer commanding U.S. Army 1895–1903; lieutenant general by act of Congress (1900): *picture* S-305
Miles City, Mont., trade center of Montana; horse, cattle, and wool district, 135 mi. n.e. of Billings on Yellowstone River; pop. 9243; railroad shops, stockyards, wool warehouses: *maps* M-375, U-252
end of the cattle trail C-152
Milet, Pierre. *See in Index* Millet, Pierre
Miletus (*mī-lē'tŭs*), great maritime city and republic on Aegean Sea in ancient Ionia, Asia Minor; colonizer and center of learning; stormed and sacked by Persians 494 B.C. for leading Ionian revolt: *map* A-27
Milfoil, or **yarrow,** perennial herbs comprising the genus *Achillea* of the composite family, with flower heads in flat, open clusters; among species which are cultivated are common yarrow or milfoil (*Achillea millefolium*) and fernleaf yarrow (*Achillea filipendulina*)
how to plant, *table* G-16
Milfoil, water. *See in Index* Myriophyllum
Milford, Conn., industrial town on Long Island Sound; pop. of township, 26,870; at mouth of Wepowaug River, 10 mi. s.w. of New Haven; oyster cultivation, vegetable and field seed growing; metal manufactures: *map* C-444
Milford, Del., city 18 mi. s.e. of Dover on Mispillion River; pop. 5179: *map* D-53
Milford, Mass., in Worcester County, on Charles River, 17 mi. s.e. of Worcester; pop. of township, 15,442; textile machinery, shoes, hats, rubber goods; near granite quarries: *map* M-133
Milhaud (*mē-lō'*), **Darius** (born 1892), French composer; formerly member ultra-modern group "Les Six"; attaché, French Legation, Brazil, 1917–19; taught composition at Mills College, Oakland, Calif., after 1940.
Milhous, Katherine (born 1894), author and illustrator of children's books, born Philadelphia, Pa.; wrote and illustrated 'Lovina', 'Snow over Bethlehem', 'The Egg Tree' (won Caldecott medal 1951), 'Patrick and the Golden Slippers', and 'Appolonia's Valentine'
Alice Dalgliesh's 'A Book for Jennifer', illustration, *picture* N-137
Military Academy, United States. *See in Index* United States Military Academy
Military Air Transport Service (MATS), U. S. A-80
Military and naval insignia, U. S. *See in Index* Insignia
Military appeals, court of, U.S. C-500
Military art and science. *See in Index* Army; United States Army; Warfare
Military aviation. *See in Index* Aviation, military and naval
Military band B-46*c*, *d*, O-402, *pictures* B-46*a–c*, O-404
Military Cross, Belgian D-40
Military Cross, British D-40
Military engineering E-345
Military Intelligence (G-2), U. S., division of General Staff A-383
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Military Law L-140, C-500
Military Medal, British D-40
Military Order of the Loyal Legion (1865) P-98
Military parks, national, U S. N-38*e*
Military Police Corps (MP), U. S. Army A-380
insignia, *picture* U-238
Military Science. *See in Index* Warfare
Military Sea Transportation Service, U. S. Navy N-90
Military service. *See in Index* Army; Conscription; United States Army
Military Staff Committee, of the United Nations U-240*a*, 241
Military tactics. *See in Index* Tactics
Militia, in U S., all able-bodied male citizens between 18 and 45, comprising National Guard, Naval Militia, Unorganized Militia
American Revolution R-125, 128
powers of U. S. Congress over U-351
Militia, state, formerly National Guard. *See in Index* National Guard
Milk M-250–3, *pictures* M-250, 250*d*–1, 253, *color pictures* M-250*a–d*, *table* M-252. *See also in Index* Butter; Cheese; Dairying; Ice cream
ancient food D-4
Babcock test for butter fat D-2
buttermilk, *table* M-252
by-products M-253, *pictures* M-253
casein: chemical formula B-145; uses other than food M-253
certified D-4, *table* M-252
colloidal in nature C-385
composition of milk of chief dairy cows, *table* C-143
cooking C-465
'cow trees' T-184
cream separator D-2–3, C-178, *picture* F-22
dairying D-2–5, *pictures* D-2–4
distribution D-2, 3, M-250*d*, *color picture* M-250*c*: in 1800's in U.S. D-2
dry cows M-250*a*
fable 'Maid and the Pail of Milk' F-3
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goat G-128–9, N-302
how cows make milk M-250–250*a*
hydrometer used in testing H-460
marketing D-3–4, M-250*d*
pasteurization P-96, M-250*d*–1
powdered or dried F-223, *table* M-252
production on dairy farm M-250*a–b*, *color pictures* M-250*a*, *b*: average production of chief dairy cows, *table* C-142
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sugar in M-252, S-446
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Milk chocolate C-289
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by machine, *picture* D-2, *color picture* M-250*c*
Milking Shorthorn, a breed of cattle C-146
Milk of magnesia, emulsion of magnesium hydroxide in water M-41
Milk of sulfur, or **lac sulfur** S-448
Milk River, in Alberta, Canada, and Montana: tributary of Missouri; 500 mi. long: *maps* M-367, 374–5, C-81, U-296, *picture* A-142
Milkshed, in dairying D-3
Milk snake, or **house snake,** a harmless common snake of North America about 4 ft. long or less; so named because of a misconception that it sucks milk from cows, although actually it seeks barns to feed on mice; strikingly colored with brownish blotches bordered with black; belongs to group of king snakes.
Milk sugar, or **lactose,** a double (disaccharide) sugar ($C_{12}H_{22}O_{11}$) reducible to galactose and glucose; differs from maltose and sucrose in structure of molecule; about one-sixth as sweet as cane sugar: S-446
Milk teeth T-34–5, *picture* T-35
Milk thistle T-120
Milk tree, common name for several species of trees of genus *Sapium* found in tropical regions; milky juice is a source of rubber.
Milkweed, perennial of genus *Asclepias* M-253–4, *picture* M-253, *color picture* F-179
directions for planting, *table* G-16
seed M-253, 254, *pictures* M-253, N-49
Milkweed butterflies, a group of the order *Lepidoptera,* family *Danaidae;* example of one species is the monarch. *See also in Index* Monarch butterfly
Milky Way, the galaxy to which the earth belongs N-106, 107, S-370–1, *charts* S-373, 377
Mill, James (1773–1836), English philosopher and economist, whose strong personality and brilliant conversation added to influence of his books ('History of British India'; 'Analysis of the Human Mind'); father of John Stuart Mill.
Mill, John Stuart (1806–73), English philosopher, economist, scholar, and enthusiastic democrat, son of James Mill, by whom he was educated; began Greek at 3, at 8 read Latin extensively; clerk in India House 33 years; exercised immense influence on contemporary thought; empiricist in philosophy, utilitarian in ethics; proprietor of *Westminster Review* 1837–40 ('Autobiography'; 'Subjection of Women'; 'On Liberty'; books on logic, economics): E-382
Carlyle C-123
women's rights W-184
Mill
cement C-166, *pictures* C-164–5
cotton C-496, *pictures* C-497: early English cotton twist mill, *picture* I-131; first spinning mill in U.S. R-135, *picture* R-143; spinning, *picture* I-64
flour F-165–7. *See also in Index* Flour and flour milling
rolling
brass B-287
steel I-244–244*c*, *d*, *pictures* I-244*a*, *b*, *c*: first mill I-247
rubber R-239
sawmill L-346–7, *pictures* L-348, 349
sugar, *picture* S-444
textile T-101
woolen W-197, *pictures* W-193–6, I-273

Mill, a machine
primitive mill for extracting peanut oil, *picture* I-55
Millais (*mĭ-lā'*), **Sir John Everett** (1829–96), English painter M-254
painting, *pictures* E-365, M-254
Millay', Edna St. Vincent (1892–1950), American poet M-254–5, A-230c
Mill-boy of the slashes, nickname applied to Henry Clay C-341
Mill'edge, John (1757–1818), American statesman and Revolutionary War patriot; governor of Georgia 1802–6; United States senator 1806–9; in 1800 presented more than 600 acres of land to University of Georgia (chartered 1785); Milledgeville, Ga., named for him.
Mil'ledgeville, Ga., town 30 mi. n.e. of Macon; pop. 8835; state capital 1807–67; seized by General Sherman (1864); Georgia Military College, State College for Women; lumber, clay products: *map* G-76
secession convention S-391
Millefleur (*mēl-flûr'*) **style**, in textile design, *picture* T-13
Mille Lacs (*mĭl lăk*), lake in central Minnesota, 16 mi. long, *maps* M-278, 287
Millennium, period of 1000 years, especially the 1000-year period referred to in the Bible (Rev. xx) as the coming kingdom of Christ on earth; also a period of happiness, righteousness, and prosperity.
Miller, Alice Duer (1874–1942), writer of light fiction, born New York City ('The Charm School'; 'Gowns by Roberta'; 'White Cliffs', a short novel in verse).
Miller, Arthur (born 1915), playwright, born New York City ('All My Sons', 1947 New York Drama Critics' Circle Award; 'Death of a Salesman', Pulitzer prize 1949; 'The Crucible').
Miller, Dayton Clarence (1866–1941), physicist, born Strongsville, Ohio; professor Case School of Applied Science; important experiments in sound, ether theory, and light.
Miller, Elizabeth Cleveland (1889–1937), author of children's books, born Seymour, Conn. ('Children of the Mountain Eagle'; 'Pran of Albania'; 'Young Trajan').
Miller, Glenn (1909–44), bandleader, born Clarinda, Iowa; organized band which brought him fame 1938; entered U. S. Army Air Force 1942; lost on a flight between London and Paris.
Miller, Henry (John) (1860–1926), American actor, born London, England; early performances with Mme. Modjeska and Adelaide Neilson; later starred in many plays, including 'Heartsease', 'The Only Way', 'The Great Divide', 'The Servant in the House'.
Miller, Hugh (1802–56), Scottish geologist and man of letters; of great influence in establishment of free Scottish church; from work on Old Red Sandstone deposits decided that creation was perfected in six long periods.
Miller, Joaquin, pen name of Cincinnatus Heine Miller (1841?–1913), American poet of the West; born in Liberty, Ind., taken as child to Oregon; was gold miner, soldier, journalist, lawyer, and judge at various times; verses colorful and vigorous though not great poetry ('Songs of the Sierras'; 'Songs of the Sunlands'; 'The Danites in the Sierras', novel, later a play)
Oakland, Calif., home O-321
quoted A-229
Miller, Kenneth Hayes (1876–1952), painter and etcher, born Kenwood, N. Y.; instructor Art Student's League, New York City, 1911–36; sculptural quality in compositions.
Miller, Lewis (1829–99), inventor, manufacturer, and philanthropist, born Greentown, Ohio; active in Sunday-school movement
helps found Chautauqua C-205
Miller, Samuel Freeman (1816–90), jurist, born Richmond, Ky.; practiced medicine 12 years; admitted to bar 1847; associate justice of U. S. Supreme Court 1862–90.
Miller, William (1782–1849), religious leader, born Pittsfield, Mass.; captain in War of 1812; from study of Bible came to believe in second coming of Christ; founded Adventist movement in U. S. *See also in Index* Adventists
Miller, popular name for several kinds of moths, so called because the fine, dustlike scales on their wings and bodies reminded people of the men who work in flour mills.
Miller, moth miller, or owlet moth, moth of the cutworm C-532
Millerand (*mēl-räṅ'*), **Alexandre** (1859–1943), president of France 1920–24; minister of war in first years of World War I; senator after 1925; sponsored many social reforms; originally a Socialist, later a Liberal.
Miller's-thumb, a small swift fish (*Cottus*) which lurks wherever salmon or trout are found, preying upon the eggs and fry of its neighbors. It is the only representative of the great sculpin family in North American fresh waters.
Millerton Lake National Recreation Area, in California N-38d, *map* N-18
Miller-Tydings Fair Trades Act, amendment to Sherman Anti-Trust law; enacted 1937; validated contracts between wholesaler and retailer designating minimum resale prices for trade-marked commodities when state laws legalized such contracts
chain-store price regulation C-182
Milles (*mĭl'lĕs*), **Carl** (born 1875), Swedish sculptor, born near Uppsala; early work influenced by Rodin; delicate and monumental subjects handled with equal skill; best known for finely designed, ruggedly modeled fountains ('Fountain of Diana'; 'Triton Fountain'): S-81
fountain in St. Louis, Mo. S-22, S-81–2, *picture* S-81
monument, Wilmington, Del. W-143, *picture* D-55
statue in St. Paul, Minn. S-24
Millesimo (*mēl-lā'zē-mō*), Italy, village 35 mi. w. of Genoa; Napoleon defeated Austrians 1796.
Millet (*mĭl'ĕt*), **Francis Davis** (1846–1912), artist and author, born Mattapoisett, Mass.; painted mural, 'Evolution of Navigation', in Custom House, Baltimore, Md.; wrote 'Capillary Crime and Other Stories'; 'The Danube'; 'The Expedition to the Philippines'; died in sinking of steamship *Titanic*.
Millet (*mē-lĕ'*, also *mĭ-lā'*), **Jean François** (1814–75), French painter M-255
Millet, or Milet, Pierre (1635–1708), French-Canadian missionary who did notable work among Iroquois Indians in New York.
Mil'let, any of various cereal grasses with small grains borne on spikes or panicles M-255–6
threshing in Japan, *picture* J-299
Mil'libar, a unit used to measure barometric pressure B-59
Mil'ligram, unit in metric system (0.015 grain) M-184
Millikan, Robert Andrews (1868–1953), physicist, born Morrison, Ill.; department of physics University of Chicago 1896–1921; director Norman Bridge Laboratory of Physics, and chairman California Institute of Technology, Pasadena, Calif., 1921–45; especially known for isolating electron and for researches on cosmic rays and on radiating properties of light atoms; won Nobel prize 1923
determines electron charge P-231
Pupin's influence P-439
Millikin University, at Decatur, Ill.; Presbyterian; founded 1901; arts and sciences, business administration, home economics, music; graduate studies.
Mil'liliter, unit in metric system (0.27 fluid drams) M-184
Mil'limeter, unit in metric system (0.03937 inch) M-184
Millimicron (*mμ*), one millionth of a millimeter.
Millin, Sarah Gertrude (born 1889), South African writer, born Kimberley, South Africa of Jewish parents; penetrating reporting on South African life ('God's Stepchildren'; 'What Hath a Man?'; 'The Dark River'; 'The People of South Africa'); also biographies ('Cecil Rhodes'; 'General Smuts').
Millinery, women's hats; originally a general term for all feminine finery. The word is probably derived from Milaner, an inhabitant of Milan, Italy, a city once famous as a trade center for women's wear: H-281–2
Milling, of coins M-292
Milling, or fulling, of cloth W-197
teasel plant used T-120, *picture* T-120
Milling machines, for working metal T-153, 154, *picture* T-150
Milling of flour F-165–7. *See also in Index* Flour and flour milling
"Millions for defense, but not one cent for tribute," phrase used by Charles C. Pinckney during 'X Y Z' affair X-332
Mil'lipede, or thousand legs, a many-legged arthropod C-171
'Mill on the Floss, The', novel by George Eliot E-330
Mills, Enos A. (1870–1922), naturalist, born Kansas City, Kan.; author of articles urging protection of birds and wild flowers, and establishment of national parks ('Wild Life in the Rockies')
in Estes Park C-402
Mills, Ogden Livingston (1884–1937), lawyer and political leader, born Newport, R. I.; practiced law in New York City and was active in New York State politics; member U.S. House of Representatives 1921–27; undersecretary of treasury 1927–32; secretary of treasury 1932–33.
Mills, Robert (1781–1855), architect and engineer, born Charleston, S. C.; studied with Thomas Jefferson; as architect of public buildings, Washington, D. C., designed the Treasury, Patent Office and old Post Office; made original design for Washington Monument, Washington, D. C., but plans were greatly modified
Jefferson encourages J-332c
Mills, Roger Quarles (1832–1911), political leader, born Todd Co., Ky.; member of Congress from Texas 1873–92; as chairman of Ways and Means Committee introduced Mills Bill; U. S. senator 1892–99.
Millsaps College, at Jackson, Miss.; founded 1892 by Methodist Episcopal Church, South; arts and sciences.
Mills Bill C-344
Mills College, at Oakland, Calif.; for women; founded 1852 in Benicia.

Calif., first Protestant academy for girls on Pacific coast; moved to Oakland 1871; chartered as a college 1885; arts and sciences, education, fine arts; graduate studies.
Millspaugh, Arthur Chester (born 1883), political scientist, born Augusta, Mich.; financial adviser to Iran (Persia), later to Haiti; written works include 'Public Welfare Organization' and 'Crime Control by the National Government' work in Iran (Persia) I-223
Millstone F-165, *picture* F-166
Millville, N.J., manufacturing city 40 mi. s. of Philadelphia at head of deep-water navigation on Maurice River; in agricultural region; pop. 16,041; glass products from glass sand obtained nearby; cotton mill and bleachery: *map* N-165
Millwork, in lumber industry W-186*b*
Milman, Henry Hart (1791–1868), English churchman, historian, and poet; dean of St. Paul's Cathedral, London ('History of Latin Christianity').
Milne (*miln*), **A(lan) A(lexander)** (born 1882), English writer M-256, *picture* M-256
Milne, John (1850–1913), English seismologist, born Liverpool; professor geology and mining, Imperial University, Tokyo; invented some seismographs; helped to establish seismological stations throughout world.
Milner, Alfred, Viscount (1854–1925), British statesman and colonial administrator; won international fame as high commissioner for South Africa 1897–1905, period which laid permanent foundations of British rule there; an Imperialist and Conservative, he opposed famous Lloyd George budget of 1909, but joined Coalition cabinet 1916 and except for Lloyd George took largest share in civilian war activities; secretary of state for colonies 1919.
Milo (*mī'lō*), or **Milon** (6th century B.C.), Greek athlete; crowned 6 times at Olympic Games and 6 times at Pythian Games for wrestling; carried an ox through stadium.
Milo, Greek island. *See in Index* Melos
Milo, a variety of grain sorghum native to Africa; introduced into U.S. about 1880; grown over Great Plains region.
Milreis (*mĭl'rās*), former monetary unit of Brazil, worth at par about 55 cents; replaced as coinage unit by cruzeiro in 1926, but retained as basis of foreign exchange; historical value about 20 cents.
Milroy, Robert Huston (1816–90), soldier, born Washington County, Ind.; served in Mexican War and in Civil War under Lee.
Milstein (*mĭl'stīn*), **Nathan** (born 1904), American violinist, born Odessa, Russia; studied with Auer and Ysaye; U.S. debut 1929; composers sensitively interpreted include Bach, Beethoven, Tschaikovsky.
Miltiades (*mĭl-tī'ạ-dēz*) (died 488? B.C.), Athenian general, victor over Persians at Marathon (490 B.C.) P-158
Milton, John (1608–74), English poet M-256–9, E-377–8, *pictures* M-256, 258, P-231
'Paradise Lost' M-259–60, L-98*b*: meter used P-335; sum received for writing B-249
poem inspired by Christmas C-299
quoted: 'L'Allegro' H-326; Shakespeare S-127; slavery S-197
'Samson Agonistes' M-260, E-378
vocabulary E-374
Wordsworth's tribute F-65
Milton, Mass., suburb 7 mi. s. of Boston, on the Neponset River; pop. of township, 22,395; settled in 1636; incorporated 1662; industrial center; chocolate, drugs, dyestuffs, pianos, artificial legs: *map, inset* M-132
Milvian (*mĭl'vē-ạn*) **Bridge,** or **Mulvian Bridge,** ancient bridge over Tiber River on Flaminian Way battle (A.D. 312) C-456
Milwau'kee, Wis., largest city of state; pop. 637,392: M-260–1, *maps* U-253, *inset* W-172, *picture* W-165
German element I-46
Milwaukee Depth, in Atlantic Ocean A-451
Milwaukee-Downer College, at Milwaukee, Wis.; for women; Milwaukee College (founded 1851) and Downer College (founded 1855) united in 1895; arts and sciences, home economics, nursing, occupational therapy.
Milwaukee River, in Wis., 100 mi. long; enters Lake Michigan at Milwaukee.
Mime (*mīm*), a form of popular comedy developed in 5th century B.C. in s. Italy; portrayed events of everyday life by means of dancing, gestures, and witty dialogue; barred from public stage by Christian church but kept alive by strolling players; preserved comic element in drama during Middle Ages and Renaissance as found in the mystery plays, interludes, and dumb shows; traces still evident in modern pantomime and vaudeville: D-131
Mimeograph, trade-mark for stencil duplicator, machine for making multiple copies of documents; commonly but erroneously applied to stencil duplicating in general; consists of a stencil and a revolving, self-inking cylinder, turned by hand or by motor; paper fed at rate of several thousand sheets per hour; originated with Thomas A. Edison's electric pen in 1875 and Albert Blake Dick's "mimeograph" duplicator in 1884: P-414*b–c*
Mimicry, among animals, resemblance in physical structure or coloring to other animals or to natural objects of their environment; provides protection or concealment. *See also in Index* Protective coloration
Mimic thrush T-123–4, M-329
Mim'idae, a family of perching birds embracing the mockingbirds, catbirds, and thrashers.
Mimir (*mē'mēr*), old giant in Norse mythology, guardian of the fountain of knowledge which watered the tree, Ygdrasil O-340
Mimner'mus (7th century B.C.), Greek poet, the first to make elegiac verse a vehicle for love poetry.
Mimo'sa, a small tree (*Mimosa nemu*) with branched trunk, smooth gray bark, and feathery compound leaves, which fold up at night; small fragrant flowers with long pink stamens borne in dense spherical clusters that suggest powder puffs; native to Asia; bark used for tanning; few varieties of acacia called mimosa.
Mimosa, Texas. *See in Index* Catclaw
Mimulus (*mĭm'ū-lŭs*), or **monkey flower,** a genus of annual and perennial plants of the figwort family, found throughout world, often in moist places. Leaves oblong or oval; stems square; flowers tubular, seeming like tiny monkey faces, yellow spotted brown or white through red: Allegheny monkey flower (*M. ringens*); common monkey flower (*M. luteus*). *See also in Index* Musk plant
Mi'na, village near Mecca, Arabia M-157
Minahassese, people of Celebes C-159
Minamoto Yoritomo. *See in Index* Yoritomo
Min'arets, slender towers of mosques provided with balconies from which are issued the calls to prayer, *pictures* A-288, I-223, I-225, I-255
Minas de Rio Tinto. *See in Index* Rio Tinto
Minas Gerais, or **Minas Geraes** (*mē'nạ zhā-rīs'*) (meaning general mines), state of interior Brazil; 229,270 sq. mi.; pop. 7,839,792; cap. Belo Horizonte: B-291–2, 288
manganese deposit, *picture* S-268
plateau, *map* B-288
Minch, strait separating Hebrides from n.w. coast of Scotland H-327, *maps* B-321, 324
Mind M-261. *See also in Index* Brain; Psychoanalysis; Psychology
historic views of E-244–5
Mindanao (*mĭn-dä-nä'ō*), southernmost and 2d largest island of Philippines; 36,906 sq. mi.; pop. 1,773,-805: P-193, 199, *maps* P-195, A-407, P-16
Moros in P-194
Mindanao Deep, in Pacific Ocean P-193
Mind cure. *See in Index* Mental therapy
Mindel, a glacial phase I-5
Mindel-Riss, an interglacial period I-5
Min'den, Germany, old town in w. on Weser River 55 mi. s. of Bremen, near which English and Prussians defeated French (1759) in Seven Years' War; pop. 41,527: *map* E-424
Mindoro, 7th largest of Philippine Islands; 3794 sq. mi.; pop. 116,988; mountainous plateau reaching height of 8800 ft. in Mt. Halcon; sugar cane, forest products: *maps* P-195, A-407
Mine, a tunnel, in medieval warfare W-9
Mine, submarine and land T-157, *pictures* T-157, A-380
mine layers and sweepers N-88, T-157: how named, *table* N-82
protection against T-157, *pictures* A-380, T-157
Mineola, N. Y., county seat of Nassau County, Long Island, 4 mi. e. of New York City limits; pop. 14,831; railway junction; trade center; packing plants: *map, inset* N-204
Miner, Jack (1865–1944), Canadian naturalist, born of English parents at Dover Center, Ohio; known for efforts to protect wild life; established bird sanctuary at his home in Kingsville, Ontario, Canada.
Mineral industries, *Reference-Outline* I-146–7
census of C-170
Mineral'ogy, defined M-261
Mineral oils F-44
petroleum and its derivatives P-168–81, *map* P-169, *pictures* P-168, 170–7, 179–81
Minerals M-261–7, *picture* M-265, *color pictures* M-263–4. *See also in Index* Mines and mining; *names of minerals;* countries, provinces, and states by name; *also* Fact Summary with each state article
carbonates M-262
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ferromagnesian R-169
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gem materials J-346, *list* J-348–50
ocean content O-328
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prospecting for M-268, E-453–4: asses carry prospector's supplies, *picture* H-428*h;* radio beam used R-41
rocks classified M-266
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Missouri M-311
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Yellowstone, *picture* Y-337
Mineral wax, or **ozokerite**
used in electrotyping E-321
Mineral Wells, Tex., health and vacation resort 45 mi. w. of Fort Worth; pop. 7801; manufacture of medicinal crystals; hunting, fishing: *map* T-90
Mineral wool, a fibrous mineral material consisting of fine, interlaced fibers, made by blowing a jet of air or steam through molten slag, glass, or certain rocks; also called rock wool, slag wool, and glass wool, depending upon raw material used; high percentage of dead air space makes it valuable for sound and heat insulation.
Miner bee, a solitary bee B-100
Miner's inch, in hydraulic mining, a unit for measuring the rate of water flow. It may be defined as the flow through a hole one inch square in a miner's inch box when the level of the water in the box is kept at 4 inches above the top edge of the hole. Under this definition, the miner's inch is about 9 gallons a minute. The definition varies in different places. The amount of water that would issue from a miner's inch box in 24 hours is known as a *water inch.*
Miner'va, in Roman mythology, goddess of wisdom, identified with Greek Athena M-267, A-466. *See also in Index* Athena
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Ming Dynasty, the ruling dynasty in China from 1368 to 1644 C-279
capital at Nanking N-4
Peking tombs P-112
porcelains P-396*a*
Minho (*mē'nyo*) **River,** Spanish **Miño** (*mē'nyō*), 170 mi. long, rises in n.w. Spain, flows s.w., and in latter part of course forms boundary between Spain and n.w. Portugal: *map* E-425
Miniature, in illumination of books and manuscripts B-236, *color pictures* B-233, 234
Persian miniature, *picture* P-157, *color picture* P-37*d*
Minié (*mĭn'ĭ-ā*) **ball,** a bullet F-79
Minim, unit of fluid measure, one-sixtieth of dram or 1/480th of a fluid ounce; roughly equal to one drop.
Minims, mendicant order founded 1454 by Francis of Paola; named by Pope Alexander VI; first known as "Hermits of St. Francis" M-358
Mini'mum age in labor C-249
Minimum wage, lowest wage which will secure to the worker and dependents physical efficiency and social decency; covers least cost of clothing, food, shelter, and medical care as determined by existing prices; some states of U.S. and foreign countries have boards to fix this wage, with varying authority to compel employers to pay it
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Henry Ford F-235
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salaries, U. S., *table* U-357
Ministry, in government, body of administrative officers
British ministry C-4
Minitari Indians. *See in Index* Gros Ventres
Minium, or **red lead** (Pb_3O_4), a red solid formed by heating lead oxide at 400° C. for some time; used on iron structures to prevent rusting.
Mink, a weasellike animal M-275, *picture* M-275
in Russia R-277
Minneap'olis, Minn., largest city of state; pop. 521,718: M-275–6, *maps* U-253, A-531, *inset* M-287, *pictures* M-290, M-276
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Minnehaha Park M-276
state university, *picture* M-291
Minneconjou (*mĭ-nĭ-kŏn'zho*), a tribe of Teton Sioux; chiefly in South Dakota; a few are in North Dakota.
Minnehaha (*mĭn-ē-hä'hä*) ("Laughing Water"), in Longfellow's poem 'Hiawatha', maiden loved by Hiawatha.
Minnehaha Falls, or **Laughing Water** Minneapolis M-276
Minnesinger (*mĭn-ē-sĭng'ẽr*), wandering singers in medieval Germany M-460
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Minneso'ta, a state in n.-central U.S.; 84,068 sq. mi.; pop. 2,982,483; cap. St. Paul: M-276–91, *maps* M-286–7, 278, 283, U-253, 286–7, *pictures* M-277, 279–80, 290–1
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Minnesota, University of, at Minneapolis, with branch at Duluth, Minn.; state control; established 1851 (present charter 1868); arts and sciences, agriculture, architecture, business administration, chemistry, child welfare, dentistry, education, forestry, general college, home economics, institute of technology, journalism, law, library instruction, medicine, mines and metallurgy, nursing, physical education, public health, veterinary medicine; graduate studies: *picture* M-291
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"Minnesota Man," prehistoric North American man I-108*f*
Minnesota River, tributary of Mississippi (450 mi. long), *maps* M-278, 287
Minneton'ka, Lake, near Minneapolis, Minn. M-276, *map* M-278
Minnewit, Peter. *See in Index* Minuit
Minnow, name often applied to any small fish; technically to those of family *Cyprinidae;* usual length

three or four inches although some members of the family grow to several feet in length
dace D-1
Mino'an Age A-28, C-327
Mino da Fiesole (*mē'nō dä fyĕ'zō-lä*), real name Mino di Giovanni (1431?–84), Italian sculptor of early Renaissance, born Poppi, near Florence, Italy; a master at carving architectural detail; executed tombs, altars, madonnas, and portrait busts.
Minor, in law, a person under legal age, which is 21 in England and generally in U.S., though 18 for women in many states.
Minor, in music. *See in Index* Music, *table* of musical terms and forms
Minorca, Balearic Islands. *See in Index* Menorca
Minorca, a breed of poultry P-402*b*, *picture* P-402*a*
Minorites. *See in Index* Franciscans
Minorities, national, racial groups forming lesser part of population of a country.
Miño River, in Spain and Portugal. *See in Index* Minho River
Minor leagues, in baseball B-64
Minor scales, in music M-469
Minos (*mī'nŏs*), in Greek mythology, king and lawgiver of Crete, son of Zeus and Europa, father of Ariadne; after his death, judge in underworld
name given to Minoan Age A-28
palace ruins C-510, *picture* C-510
Theseus and the Minotaur T-117
Minot (*mī'nŭt*), **Charles** (1810–66), railroad official, born Haverhill, Mass.: R-66
Minot, George Richards (1885–1950), medical scientist, born Boston, Mass.; began teaching at Harvard, 1928; shared, with William P. Murphy and George H. Whipple, Nobel prize (1934) for discovery of value of raw liver or liver extract in the treatment of anemia.
Minot, N. D., trade center on Souris River 200 mi. w. of Grand Forks; pop. 22,032; coal, flour; State Teachers College: *maps* N-288, U-252
Minotaur (*mĭn'ō-tär*), in Greek mythology, bull-headed man-monster, eater of human flesh; imprisoned by Minos in Cretan labyrinth: T-117
labyrinth C-510
Minot's Ledge, lighthouse L-236
Min River, s.e. China, enters Formosa Strait; lower course navigable
Foochow on F-209
Minsk (*minsk*), Russia, capital of White Russian S. S. R., 430 mi. s.w. of Leningrad; pop. 231,000: *maps* R-267, E-417
Minster, monastery church
origin of term M-355
Minstrel, Negro, theatrical performance D-14*l*
Minstrels, medieval bards M-460
'Nibelungenlied' N-232
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'Minstrelsy of the Scottish Border', collection of ballads by Scott S-67
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used with tea T-32
Mint, United States M-292–3
Mint camphor. *See in Index* Menthol
Mintha, in Greek mythology M-291
Min'to, Gilbert John Elliott-Murray-Kynynmond, 4th earl of (1845–1914), English statesman, born London; served as governor general of Canada 1898–1904 and as viceroy of India 1905–10.
Minto, Lake, in n.w. Quebec; 485 sq. mi.: *maps* C-69, 72
Minton, Sherman (born 1890), jurist, born Georgetown, Ind.; public counselor of Indiana 1933–34; U.S. senator (Democrat) from Indiana 1935–41; judge U.S. Seventh Circuit Court of Appeals 1941–49; named justice of U.S. Supreme Court September 1949.
Minuend, in substraction, *table* S-439*b*
Minuet. *See also in Index* Music, *table* of musical terms and forms
in symphony M-463
Min'uit, or **Minnewit, Peter** (1580–1638), colonial official for Dutch and Swedish West India Companies; obtained right to settle on Manhattan Island from Wappinger Indians and built Fort Amsterdam 1626: N-213, A-198
leads Swedish people in Delaware colony D-60
Minuscule (*mĭn-ŭs'kŭl*), lower-case alphabet B-235, A-179
Minute, divided into 60 seconds B-6*b*
Minute, in measuring angles
latitude and longitude L-133
'Minute Man, The', statue by Daniel French L-178, F-284
Minuteman plow, *picture* A-58
Minutemen, American colonial militia, so called because of readiness for action at a minute's notice
flags: Bedford, Mass. F-130*c*, *color picture* F-128; Culpeper County, Va. F-130*c*, *color picture* F-128
Lexington and Concord L-178: Lexington, *picture* R-126
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Miocene (*mī'ō-sēn*) **epoch**, in geologic time, *diagram* G-58, *table* G-57
Miquelet lock pistol, *picture* F-77
Miquelon, French island, administered with St. Pierre. *See in Index* St. Pierre and Miquelon
Mir (*mēr*), Russian village community R-264
Mira, a variable star in constellation Cetus, *chart* S-379
Mirabeau (*mē-rȧ-bō'*), **Honoré Gabriel Riqueti, Count** (1749–91), French Revolutionary statesman M-293
Mirab'ilite, a mineral, sodium sulfate M-265
Miracle plays, religious plays of Middle Ages M-293, D-131, D-14*e*, *pictures* D-131, 132, M-238*b*
Spanish S-326
Miracle tale, in Chaucer's 'Canterbury Tales' C-203, 204
Miraflores (*mē-rä-flō'räs*) **Locks**, in Panama Canal P-63, *map* P-62, *picture* P-59
Mirage (*mĭ-räzh'*), an optical illusion M-294–5, *pictures* M-294
Miramichi (*mĭr-ȧ-mē-shē'*) **River**, in New Brunswick; abounds in fish: N-138*a*, *picture* N-138
Miran'da, Francisco de (1750–1816), Spanish-American revolutionist, born Carácas, Venezuela; served with the French in the American Revolutionary War and later in the French Revolution, during which he was imprisoned; returning to South America in 1806 he initiated a revolution in Venezuela, but was captured by the Spanish in 1812 and died four years later in prison
designed flag of Venezuela F-138
dictator of Venezuela V-442
Miranda, in Shakespeare's 'Tempest', daughter of Prospero T-56
Mirbeau, Octave (1850–1917), French novelist and playwright; his story of Norman peasants 'Lettres de ma Chaumière' (1886) had a wide appeal; noted for plays ('Celestine'; 'Torture Garden'; 'Calvary'; and play produced in New York City 1905 as 'Business Is Business')
estimate of Maeterlinck M-28
Mir'iam, Hebrew prophetess, sister of Moses (Exod. ii; xv, 20).
Mir Jafar (*mēr gä'fēr*) (1691–1765), Indian general and ruler C-352
Miró, Joan (*hwän mē-rō*) (born 1893), Spanish painter; early work influenced by Van Gogh, later painted abstractions, finally turned to surrealism; ingenious use of color, fine sense of design ('Dog Barking at the Moon'; 'The Farmer's Wife')
'Harlequin's Carnival' P-34*d*–5, *color picture* P-34*c*
Mirror M-295, L-229
18th century, *picture* I-180
in 15th-century Flemish home, *color picture* P-25*a*
interior decoration, *pictures* I-179, 180
polarization of light L-234
reflecting telescope T-47–8
reflection, law of L-229
Mirror carp, fish C-127
'Misanthrope, Le' (*lŭ mē-zäṅ-trôp'*), comedy by Molière (1666); kind and sensitive Alceste, because of the insincerity in conventional society, becomes a cynic and misanthrope (hater of mankind).
Mischmetall, an alloy A-174
Misdemeanor, in law. *See in Index* Law, *table* of legal terms
'Misérables, Les' (*lā mē-zā-rȧ'blŭ*) (The Unfortunates), novel by Victor Hugo H-441–2
Miserere (*mĭz-ē-rē'rē*), a musical setting of the 50th Psalm in the Vulgate beginning *Miserere Mei, Domine* (Have mercy upon me, O Lord); in architecture, projection on underside of medieval church seats which afforded support to a person standing when the seat was turned up; also called Miséricord.
Misericordia, College, at Dallas, Pa.; Roman Catholic; for women; founded 1924; arts and sciences, home economics, library science, nursing, secretarial science.
Mishawa'ka, Ind., manufacturing center 4 mi. e. of South Bend on St. Joseph River; pop. 32,913; automobiles, machinery, trunks, rubber goods, furniture: *map* I-78
Mish'na, part of Talmud H-327
Mis'pickel, or **arsenopyrite**, a mineral composed of iron, sulfur, and arsenic, containing 46 per cent arsenic; principal source of "white arsenic" of commerce; occurs in veins associated with various ores of gold, lead, tin, etc.; silver-white in color.
Misquah Hills, elevated region in n.e. Minnesota containing highest point in state (2230 ft.): *map*, *inset* M-286
Missal, the book containing the service for the celebration of the Mass in Roman Catholic churches.
Missel thrush T-126
Missiles, guided. *See in Index* Guided missiles
Missin'aibi River, Ontario, Canada; flows 265 mi. into Moose River: *maps* C-69, 72
Missing link A-272
Plesianthropus transvaalensis M-70
Mission, Captain, 17th-century French pirate, famed for eloquence and courtly manners; derived socialistic ideas from an ex-priest named Carraccioli, his lieutenant, and founded ideal colony on island off Madagascar; drowned at sea.
Mission, Tex., city 53 mi. n.w. of Brownsville; pop. 10,765; citrus fruit and vegetable packing and processing: *map* T-91
Mission architecture, Spanish-American style developed particularly in California and the Southwest A-319, C-46, S-308*a*, *pictures* C-45, S-308

Mnesicles (*nĕs'ĭ-klēz*), Greek architect; designed Propylaea of the Athenian Acropolis about 437 B.C.: A-11

Mo'a, extinct bird of New Zealand, similar to the emu; remains of 20 species have been found: *picture* T-27

Moa, river in Cuba rising in e. end of Sierra Maestra; flows into Guantánamo Bay.

Moab (*mō'ăb*), or **Mo'abites**, Semitic tribe in ancient Palestine e. of Dead Sea and the Jordan; frequently in conflict with Israelites; conquered by David
- alphabet, *chart* A-177: Moabite stone, *table* A-178
- Ruth, the Moabite R-299

Moabite stone, slab of black basalt, dating from 9th century B.C., which bears ancient Semitic inscription describing victory of Mesha, Moabite king, over Israelites. Negotiations for its purchase by the French led to quarrels among the Arabs and it was broken; fragments now in Louvre, Paris: *table* A-178

Moat (*mōt*), a ditch, often filled with water, around castle C-132, *picture* C-133

Mobangi River, in Africa. *See in Index* Ubangi River

Moberly, Walter (1832–1915), Canadian civil engineer, born Oxfordshire, England; came to Canada when a child; 1859 made superintendent of public works in British Columbia; 1871 had charge of surveys for Canadian Pacific Railway ('History of Cariboo Wagon Road'; 'The Early History of the Canadian Pacific Railway').

Moberly, Mo., industrial city 132 mi. n.w. of St. Louis; pop. 13,115; coal mines nearby; railroad shops; trade in livestock, hides and farm produce: *maps* M-318, U-253

Mobile (*mō-bēl'*), Ala., seaport and 2d city of the state; pop. 129,009: M-327–8, *maps* A-127, U-253, *pictures* M-328, A-117, 118
- history A-120, M-327–8: Civil War M-328, F-37, *map* C-334

Mobile (*mō'bĭl* or *mō'bēl*) and **stabile** (*stā'bĭl* or *stăb'ĭl*), in art S-83, *picture* S-83. *See also in Index* Calder, Alexander

Mobile Bay, Ala., 27 mi. long, 8 mi. wide A-118, 120, *maps* A-114, 127
- naval battle F-37

Mobile River, in s.w. Ala., *maps* A-114, 127
- at Mobile M-328

Mobile telephone T-45

Mobilization, military and naval term for the assembling of army and fleet for war.

'Moby-Dick', romantic novel by Herman Melville telling the adventures of Captain Ahab who, after losing a leg in first battle with Moby Dick, the white whale, swears revenge; the three days' fight with Moby Dick ends in death of whale and sinking of ship: M-168, 169, A-227, N-311
- illustration, *picture* W-111

Moçambique. *See in Index* Mozambique

Moc'casin, Indian shoe, usually made of deerskin or other soft leather; often trimmed with beads or shells: *picture* S-162
- Eastern Woodland moccasin, *color picture* I-98
- Plains moccasin, *picture* I-104b

Moccasin flower L-84, *color picture* F-178
- state flower of Minnesota M-281, *color picture* S-384a

Moccasin snake also called cottonmouth M-328, V-476, *picture* S-206

Mocha (*mō'kä*), fortified seaport in Yemen, s. Arabia, on Red Sea; 130 mi. w. of Aden; pop. 600; gave name to Mocha gloves and Mocha coffee: *maps* A-285, A-407

Mocha coffee C-378, 380

Mocha gloves G-126

Mocha stone, an agate from India with a green or dark brown design resembling vegetation.

Mockernut hickory, tree (*Hicoria alba*) of walnut family, native from Mass. to Fla. and Tex. H-355

Mockingbird M-328–9, *color pictures* B-164, 185
- egg M-329, *color picture* E-268a
- nest M-329, *color picture* B-164
- state bird, *table* B-158

Mock orange. *See in Index* Syringa

Mock suns. *See in Index* Sun dogs

Moctezuma River, in s.e. Mexico M-191, *maps* M-189, 195

Mode, or modal average, a measure of average S-385e

Mode, or mood, of verb V-449–50

Model, of geographic region from contour map M-89–91

Model airplane A-107–10, *diagrams* A-108, *pictures* A-108–10, V-429

Modeling, in art
- books about H-399
- sand modeling, *picture* P-86c
- sculpture S-74–5

Model Law, or Audubon Law B-195–6

Model Parliament P-88

Model T Ford, *picture* A-504

Model train, *picture* R-69d

Modena (*mō'dā-nä*), city in n. Italy 100 mi. e. of Genoa; capital of province of Modena; pop. 109,934; fine Romanesque cathedral; famous campanile; university founded 1683: *maps* I-262, E-425
- joins United Italy I-273, V-468

Moderato. *See in Index* Music, *table* of musical terms and forms

Moderator, substance such as graphite, heavy water, or beryllium used to slow down neutrons in nuclear reactor A-467, *diagram* A-468

Modern Art, Museum of, New York City N-225

Modern dance D-14, *pictures* D-14–14a, i, j
- musical comedy D-14m

Modern history H-360, *charts* H-365–8, *pictures* H-375–82, *Reference-Outline* H-375–82

Modernism, an artistic movement which emphasizes simplicity of design and suppresses incidental or merely decorative detail
- architecture A-323–4
  - church, Copenhagen, *picture* B-346
  - church, Germany, *picture* A-319
  - church, Tulsa, Okla., *picture* O-373
  - Frank Lloyd Wright's work, *pictures* W-308
  - house, *picture* A-322
  - Iceland, theater, *picture* I-12
  - livestock-judging pavilion, *picture* N-278
  - Nebraska Capitol, *picture* N-105
  - United Nations Secretariat, *picture* A-400f
- bookbinding B-241
- interior decoration I-181–2, *pictures* I-176, F-320, A-400f
- literature: Latin American L-124–5
- Russian experiments R-275
- sculpture S-82–3, *pictures* S-82–3, A-400i: Rodin's influence S-81

'Modern Reader's Bible' L-98b

Modern Woodmen of America, a fraternal, beneficiary society, providing life insurance to members; founded at Lyons, Iowa, in 1883; the women's auxiliary is known as the Royal Neighbors of America.

Modes'to, Calif., city in central California 70 mi. s.e. of Sacramento; pop. 17,389; condensed milk, canned and packed fruits: *maps* C-34, U-252

Modification, in biology E-452

Modifier, in grammar S-101
- adjective A-21
- adverb A-23

Modigliani, Amedeo (*ä-mā-dā'ō mō-dē-lyä'nē*) (1884–1920), Italian painter; spent most of life in Paris; identified with the modern French school of art
- 'Girl with Braids' P-34b, *color picture* P-34
- stone head by S-76, *picture* S-75

Modjeska (*mō-ğĕs'kä*), **Helena** (1840–1909), American tragic actress, born Cracow, Poland; after successful career in Poland moved to U.S.; performed in English after 1877 (Shakespearean roles; 'Camille'; 'Mary Stuart')
- encouraged Paderewski P-19a

Mo'doc Indians, a small warlike tribe closely related to the Klamath, and originally living in n. California and s. Oregon; resistance to being moved to reservation led to Modoc War of 1872–73; later moved to Indian Territory (now Oklahoma) and to Klamath reservation in s. Oregon: I-110c
- lava beds furnish fortress N-36

Mo'dred, Sir, King Arthur's nephew and one of knights of Round Table R-236

Modulation, in music M-461. *See also in Index* Music, *table* of musical terms and forms

Modulation, in radio R-36, 37, 45
- television T-54a

Moe (*mō'ĕ*), **Jörgen Engebretsen** (1813–82), Norwegian folklorist and poet; bishop of Kristiansand, collected folk tales in collaboration with Peter C. Asbjörnsen; wrote lyric poems of delicate charm ('In the Well and the Churn'; 'A Little Christmas Present').

Möen (*mû'ĕn*), Danish island in the Baltic Sea between Zealand and Falster; 84 sq. mi.; pop. 14,156; fertile soil; farms and fisheries; chalk cliffs: *maps* D-71, E-424

Moench, peak of Alps. *See in Index* Mönch

Moero, Lake, in Africa. *See in Index* Mweru

Moesia (*mē'shĭ-ą*), ancient Roman province s. of Danube River corresponding to modern Bulgaria and e. Yugoslavia; settled by Goths about A.D. 376.

Moffat, David Halliday (1839–1911), banker, born Washingtonville, N. Y.; president First National Bank, Denver; promoted mining industry of Colorado.

Moffat, Robert (1795–1883), Scottish missionary in Africa; father-in-law of David Livingstone; worked among Bechuana tribes 50 years and translated Bible into their language.

Moffat Tunnel, on Denver and Salt Lake Railroad; built 1923–27; named for David H. Moffat, builder of original railroad line: C-414, D-73, *map* C-408

Moffett Field, U. S. Air Force base 21 mi. s.e. of San Francisco
- wind tunnel, *picture* A-96

Mogadiscio (*mō-gą-dē'shō*), also **Mogadishu**, seaport and capital of former Italian Somaliland; pop. 58,000: *maps* E-402, A-46

Mogador (*mŏg-ą-dōr'*), French Morocco, seaport on Atlantic coast; pop. 22,291: *maps* A-167, A-46

Mogok, village in Upper Burma; in valley 4000 ft. high; rubies and sapphires mined.

Mogollan-Mimbres culture, of prehistoric North American Indians I-109

Mogul (*mō-gŭl'*), **Great**, popular European name of Indian emperors descended from Baber, the first Great Mogul (died 1530) M-346
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Mohacs (*mō'häch*), town in s. Hungary on Danube River; pop. 19,083; coal and silk center; two battles, at the beginning and close of Turkish rule of Hungary: *map* E-425
battle (1526) H-450. *See also in Index* Battles, *table*
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Moham'med, or **Muhammed**, also Mahomet (570–632), Arabian prophet, founder of Islam M-329–30. *See also in Index* Mohammedanism
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Mohammed II (1430?–81), sultan of Turkey 1451–81; educated, ambitious, brave, but ruthless
gains Constantinople T-220
Mohammed V (1844–1918), sultan of Turkey 1909–18.
Mohammed VI (1861–1926), sultan of Turkey, deposed 1922 by Nationalist Assembly T-220*a*
Mohammed Ali. *See in Index* Mehemet Ali
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wood carving, *picture* W-190
Mohammed Reza Pahlavi, or **Pahlevi** (born 1919), shah of Iran from 1941, born Teheran, Iran; son of Reza Shah Pahlavi: I-224
Mohammed Zahir Shah (born 1914), king of Afghanistan; succeeded father Nadir Shah who was assassinated in 1933: A-33
Mohave (*mō-hä'vä*), **Lake**, on boundary between s.e. Nevada and n.w. Arizona, formed by Davis Dam C-415, *maps* A-352, C-414*b*, N-133
Mohave Desert, or **Mojave Desert**, a desert region in s.e. California; 15,000 sq. mi.; entered first by Spanish priest 1776; many dry lakes; gold, silver, tungsten, borax, potash, and cement; agriculture possible in some sections; plants and animals peculiarly adapted to dry climate: *maps* C-26, 35, D-73*a*, U-303, *picture* C-40
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Mohave Indians. *See in Index* Mojave
Mo'hawk, leading Indian tribe of Iroquois group, formerly living in lower Mohawk Valley, N. Y.: *table* I-107
Mohawk River, in e.-central New York, flows e. 175 mi. through fertile valley N-196, *maps* N-196, 205, U-265
travel route U-265, *color picture* U-267
Mohegan (*mō-hē'găn*), Indian tribe of Algonquian stock, originally living in Connecticut, Rhode Island, and Massachusetts; after destruction of Pequots they were most powerful tribe in s. New England.
Moheli, island. *See in Index* Comoro Islands
Mohican. *See in Index* Mahican
Mohl, Hugo von (1805–72), German botanist, born Stuttgart; studied anatomy of plants; in 1846 suggested term "protoplasm" to specify substance of cell body as opposed to substance of nucleus.
Mohmand (*mō'mănd*), a tribe of Afghanistan and India A-31
Moholy-Nagy (*mō'hō-lĭ näg*), **Ladislaus** (1895–1946), Hungarian painter, photographer, stage designer, and architect; professor in original Bauhaus in Weimar and Dessau, Germany; voluntary exile from Germany after 1935; director New Bauhaus (later Institute of Design), Chicago.
Mohs scale, a scale of the hardness of minerals, devised by Friedrich Mohs (1773–1839), German mineralogist: M-261
Moire (*mwär* or *mwä-rā'*), silk or cotton cloth having a watered finish produced by engraved rollers, heat, and pressure.
Moissan (*mwä-sän'*), **Henri** (1852–1907), French chemist; developed electric furnace for laboratory use and simplified production of acetylene gas; isolated elementary fluorine; produced carborundum independently of Acheson's discovery; Nobel prize for chemistry 1906.
Moissi (*mō-ē'sē*), **Alexander** (1880–1935), German-speaking actor of international reputation, born Trieste (then in Austria) of Italian mother and Albanian father; made first stage appearance in Vienna; later played throughout Europe and in U.S. ('Hamlet'; Fedya in Tolstoy's 'Redemption'); noted for melodious and haunting quality of his voice.
Moisture. *See also in Index* Humidity
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cause of moisture on outside of water vessels or pipes D-77
climate regions C-350–1
factor in weather W-77
temperature variations affect C-349–50
Mojarras (*mō-här'äz*), one of group of heavy-bodied food fishes of small or moderate size (*Gerridae*), covered with large silvery scales; most of the species are American and abundant on both the Pacific and the Atlantic coast.
Mojave (*mō-hä'vä*), or **Mohave**, Indian tribe that lives in Arizona, *map* I-106*f*, *table* I-107
Mojave Desert. *See in Index* Mohave Desert
Mokalla, Aden Protectorate. *See in Index* Mukalla
Mokelumne (*mō-kĭ-lŭm'nĭ*) **River**, in n.-central California; flows into San Joaquin River; 200 mi. long
Salt Springs Dam, *picture* D-9
Mol, in chemistry S-234
Mola, Emilio (1887–1937), Spanish general, born in Cuba; served in Spanish army in Morocco, 1926; chief of police in Spain; next in command to Franco in Spanish civil war; killed in airplane crash
originator of expression "fifth column" W-250
Molar solutions, in chemistry S-234–5
Molar teeth T-34, *picture* T-36
Molas'ses S-446
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sugar cane molasses S-444
viscous liquid M-142*a*
Molasses Act, British (1733), imposed duties on all sugar and molasses brought into the American Colonies from other than British possessions
modified (1764) R-121
Molay, Jacques de (1243–1314), last grand master of the Knights Templars; born Burgundy; summoned to Paris by pope to answer charges brought against order, confessed truth of some; sentenced to life imprisonment; he recanted his confession, and he was thereafter burned to death.
Mold, fungus growth M-247–8, *pictures* M-247
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cheese C-206
killed by heat in canning F-219
Mold, in casting sculpture S-75
Moldau River, Czechoslovakia. *See in Index* Vltava River
Moldavia (*mŏl-dā'vĭ-ą*), also **Moldova**, district in Rumania between Prut River and Carpathian Mts.; 14,710 sq. mi.; pop. 2,140,000: R-252–3, 254
Moldavian Soviet Socialist Republic, 13th constituent republic of Russia; pop. 2,660,000; created 1940 by combining central Bessarabia, acquired from Rumania, with the autonomous Moldavian Republic which was formerly part of Ukraine: *maps* R-260, 267

Mol'davite, a green natural glass possibly of meteoric origin; sometimes cut as gem; found in Moldavia and Australia.
Moldboard plow P-321, *picture* P-322
Molding. *See in Index* Architecture, *table* of terms
Mole, a small insect-eating mammal M-332, *pictures* M-332, N-59
foot, *picture* H-256
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shrew related to S-168
Molech. *See in Index* Moloch
Mole cricket C-513
Molec'ular theory of magnetism M-42–3, E-304
Molecule (*mŏl'ĕ-kūl*), two or more atoms chemically combined C-210, A-456, M-142*b*
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surface tension L-262, *diagrams* L-263–4
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Molehill M-332
Molenaer (*mō'lĕ-när*), **Jan Miensze** (1610–68), Dutch painter; scenes of peasant life, sometimes humorous; influenced by Frans Hals and Rembrandt
'Young Lady Playing the Harpsichord', *picture* P-248
Mole shrew, or short-tailed shrew S-168
Molesworth, Mary Louisa Stewart (1839–1921), Scottish author of children's books; born in Rotterdam, Netherlands ('Carrots', 'Cuckoo Clock').
Molière (*mô-lyêr'*), stage and pen name of Jean-Baptiste Poquelin (*pôk-lăn'*) (1622–73), French dramatist M-332–3, *picture* F-286
Moline', Ill., manufacturing city in n.w. on Mississippi River adjoining Rock Island and just across the river from Davenport, Iowa; pop. 37,397; numerous mills and factories; known especially for its manufacture of farm implements; excellent water power; coal fields nearby: *maps* I-36, U-253
Molino del Rey (*mō-lē'nō dĕl rā*) ("king's mill") Mexico, massive stone buildings 3 mi. w. of Mexico City; battle in Mexican War (1847) resulting in Mexican defeat.
Mollendo (*mō-yĕn'dō*), Peru, seaport for Arequipa; also a port for Bolivian commerce; one of Peru's exporting points for wool; pop. 12,259: *maps* P-164, S-252
Mollie, any of several species of tropical fish belonging to family *Poeciliidae*: *color picture* F-104
Mollison, James Allan (born 1905), English aviator, established many records; made first east-west solo flight across n. Atlantic 1932: *table* A-104
Molluscoidea (*mŏl-ŭs-koi'dē-ą*), a phylum of invertebrate animals including the Bryozoa and Tunicates.
Mol'lusks, or **Mollusca**, a phylum of soft-bodied, unsegmented animals, usually bearing shells M-333–4, *Reference-Outline* Z-364
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cephalopod M-333: nautilus N-70, *pictures* N-69–70; octopus, cuttlefish, and squid O-337–9, *pictures* O-337–9
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place in "family tree" of animal kingdom, *picture* A-251
shells S-138–41, *pictures* S-141, *color pictures* S-139–40
Mollweide, map projection M-86
Mollwitz (*môl'vĭts*), Poland, former German village 25 mi. s.e. of Breslau, where Frederick the Great defeated Austrians under Marshal Neipperg (1741) in First Silesian War; included in Poland since 1945.
Molly Maguires, a secret organization founded 1845 in Ireland to resist rent collectors; also a similar organization in mining districts of Pennsylvania, suppressed 1877 after execution of leaders for murders of mine officials: C-369
Molnar (*môl'när*), **Ferenc** (1878–1952), American dramatist, born Hungary; in U. S. after 1940; brilliant technique and subtle irony; cynical and disillusioned in his attitude toward life; many of his plays produced in America ('Liliom'; 'The Guardsman'; 'The Swan'; 'Olympia'); also wrote novels ('The Pál-street Boys'), short stories, and essays: D-134
Moloch (*mō'lŏk*), or **Molech**, Semitic fire-god (II Kings xxiii, 10) J-335, P-205
Molokai (*mō-lō-kä'ē*), island of the Hawaiian group; 259 sq. mi.; pop. 5280: H-288*a*, *maps* H-286, P-17
Molonglo River, small stream of New South Wales, Australia C-110
Molotov (originally **Scryabin**), **Vyacheslav Mikhailovich** (born 1890), Russian political leader M-334, R-292*a*, *pictures* M-334, H-380, R-292*a*
signs Nazi-Soviet pact, *picture* W-248
Molotov, Russia, formerly **Perm** (*pĕrm*), city on Kama River about 175 mi. n.w. of Sverdlovsk; pop. 450,000; iron, machinery; copper smelting: *maps* R-266, E-417
Molotov cocktail (named for V. M. Molotov), a form of hand grenade made from bottle containing inflammable fluid; used chiefly by Russians against German tanks and armored vehicles in World War II.
Molson, John (1764–1836), Canadian capitalist and pioneer in steam navigation, born Lincolnshire, England; emigrated to Canada 1782; 1809 ran steamship on St. Lawrence River; 1832 made member of Legislative Council; 1826–34 president of Bank of Montreal.
Molting
birds B-175–6
caterpillars L-104, C-137
insects I-156, *picture* I-156
lobsters L-287
spiders S-345
ticks S-348
Moltke (*mōlt'kŭ*), **Helmuth Johannes, count von** (1848–1916), German general, nephew of Count H. K. von Moltke; chief of staff at outbreak of World War I; superseded by Falkenhayn December 1914: W-220
Moltke, Helmuth Karl, count von (1800–1891), Prussian field marshal and chief of staff, greatest strategist of latter 19th century; reorganizer of Prussian army; planned campaigns against Austria (1866) and France (1870–71); a strong reserved man, "silent in 7 languages"
Franco-Prussian War F-277
quoted on Washington W-21
Molto. *See in Index* Music, *table* of musical terms and forms
Moluc'cas, or **Spice Islands**, group of islands in Indonesia, between Celebes and New Guinea; 30,168 sq. mi.; pop. 893,400; export spices, sago, coconuts, pearls: *maps* E-203, P-16
cloves C-360
Spanish-Portuguese dispute M-32
Molucca Sea, part of Pacific Ocean e. of Celebes, *maps* E-202, A-407
Mo'ly, fabled flower that protected Odysseus from Circe C-309
Molybdenite (*mō-lĭb'dē-nīt*), a soft sulfide of molybdenum (MoS_2), chief ore of that metal; U. S. is principal world producer, largely from Colorado mines: M-335
Molyb'denum, a metallic chemical element M-335, *tables* P-151, C-214
Colorado C-412
electric furnace employs F-317, M-335
filament supports in electric lamps E-310
ore M-262, *color picture* M-264
salts in ink I-150
Mombasa (*mŏm-bä'sä*), main port of Kenya, East Africa; on Mombasa island; railroad bridge and a causeway connect it with mainland; pop. 84,746. Mombasa's harbor Kilindini is one of best in Africa: E-199, K-35, *maps* E-199, A-47
Momen'tum, the power of a moving body to overcome resistance; equals the mass of the body multiplied by its velocity: M-162
conservation of R-55
Mommsen (*mŏm'zĕn*), **Theodor** (1817–1903), German classical scholar and historian, called by Freeman "well-nigh greatest scholar of all times"; his 'History of Rome', though biased in favor of monarchy, "one of most masterly histories ever written"; Nobel prize winner for literature 1903.
Momotom'bo, active volcano of Nicaragua on n.w. shore of Lake Managua N-232
Momsen lung, for submarine escape S-438, *picture* S-438
Momus (*mō'mŭs*), in Greek mythology, god of censure and mockery who found fault with everything and burst with spite because unable to find flaws in Aphrodite. Son of Night according to Hesiod.
Monaco (*mŏn'ä-kō*), **Albert Honoré Charles, prince of** (1848–1922), ruler of the principality of Monaco and oceanographer; succeeded his father, Charles III, 1889; served in Spanish and French navies; investigated deep-sea life.
Monaco, small principality on Mediterranean, bordered on land sides by s.e. France; about 370 acres; pop. 20,202: M-379, *maps* F-259, E-425
city: Monte Carlo M-378–9
flag F-136*b*, *color picture* F-133
Monad'nock, Mount, in s. New Hampshire (3166 ft.) N-143, *maps* N-144, 151
Monadnocks, in geology R-176, E-189, *diagrams* E-189
Mon'aghan, inland county in Ulster province, Ireland; 498 sq. mi.; pop. 55,345; agriculture: *map* I-227
'Mona Lisa' (*mō'nä lē'zä*), Da Vinci's great portrait, also called 'La Gioconda' V-474, P-27, *picture* E-443, *color picture* P-26*b*
Mona Passage, West Indies, a waterway between Hispaniola and Puerto Rico; 80 mi. wide: *maps* W-96*a*, N-251
Monarch butterfly, an insect (*Danaus plexippus*) of the order *Lepidoptera*, family *Danaidae*; breeds on milkweeds: B-367*c*, *d*, *color picture* B-365
egg, *pictures* I-157, E-269
food for larva M-254

FOREIGN MONETARY UNITS AND THEIR UNITED STATES EQUIVALENTS

After 1934, when the United States and most other nations went off the gold standard, the nominal values of foreign moneys and their actual exchange values came to differ widely. These values also changed frequently. As a result, no permanent reference table of values can be given. This table gives the names of foreign monetary units and their equivalents in United States money on one day during 1955. These figures were supplied by the Chase Manhattan Bank of New York City. Newspapers or banks should be consulted for the latest values of foreign money.

Country	Monetary Unit	U.S. Equivalent
Afghanistan	Afghani	$ .048
Albania	Lek	.02
Andorra	Spanish peseta	.0235
	French franc	.00287
Argentina	Peso	.0724
Australia	Pound	2.23
Austria	Schilling	.0386
Belgium	Franc	.02
Bhutan	Rupee	.21
Bolivia	Boliviano	.0055
Brazil	Cruzeiro	.014
Bulgaria	Lev	.1475
Burma	Kyat	.2115
Cambodia	Piaster	.03
Canada	Dollar	1.03⅝
Ceylon	Rupee	.21
Chile	Peso	.0055
China	Jin Min Piao	24,400 to $1.00
Colombia	Peso	.40
Costa Rica	Colon	.1515
Cuba	Peso	1.001
Czechoslovakia	Koruna	.14
Denmark	Krone	.1455
Dominican Republic	Peso	1.00
Ecuador	Sucre	.058
Egypt	Pound	2.8825
Ethiopia	Dollar	.4035
Finland	Finmark	.0045
France	Franc	.00287

Country	Monetary Unit	U.S. Equivalent
Germany, East	Mark	.4504
Germany, West	Mark	.2385
Great Britain	Pound	2.785
Greece	Drachma	.0333
Guatemala	Quetzal	1.00
Haiti	Gourde	.20
Honduras	Lempira	.50
Hungary	Forint	.086
Iceland	Krona	.062
India	Rupee	.209
Indonesia	Rupiah	.09
Iran	Rial	.0128
Iraq	Dinar	2.80
Ireland	Pound	2.785
Israel	Pound	.56
Italy	Lira	.00161
Japan	Yen	.0028
Korea, North	Won	61,349 to $1.00
Korea, South	Hwan	.0055
Laos	Piaster	.03
Lebanon	Pound	.31
Liberia	Dollar	1.00
Libya	Pound	2.80
Liechtenstein	Franc	.23335
Luxemburg	Franc	.02
Mexico	Peso	.0802
Monaco	Franc	.0029
Mongolian People's Republic	Tugrich	.25
Nepal	Rupee	.21
Netherlands	Guilder	.2637
New Zealand	Pound	2.775
Nicaragua	Cordoba	.1525

Country	Monetary Unit	U.S. Equivalent
Norway	Krone	.1405
Oman	Maria Theresa dollar	.4035
	Lakh	Not available
Pakistan	Rupee	.301
Panama	Balboa	1.00
Paraguay	Guarani	.017
Peru	Sol	.053
Philippine Islands	Peso	.4995
Poland	Zloty	.25
Portugal	Escudo	.035
Rumania	Leu	.1666
Russia	Ruble	.25
Salvador, El	Colon	.40
San Marino	Lira	.00161
Saudi Arabia	Riyal	.275
Siam (Thailand)	Baht	.05
South Africa, Union of	Pound	2.78⅞
Spain	Peseta	.0235
Sweden	Krona	.1935
Switzerland	Franc	.2333
Syria	Pound	.285
Trans-Jordan (Jordan)	Dinar	2.82
Turkey	Pound	.3575
Uruguay	Peso	.315
Vatican City	Lira	.00161
Venezuela	Bolivar	.30
Viet Nam	Piaster	.03
Yemen	Rupee	.21
Yugoslavia	Dinar	.0033

Monarchy (*mŏn'ẽr-kĭ*) (from Greek words *monos* meaning "alone" and *archein*, "to be first, or to rule"), a form of government G-146, D-63
constitutional monarchy D-65
origin of kings G-145

Monarda (*mō-när'da*), or **horsemint**, a genus of plants of the mint family, including bergamot, bee balm, or Oswego tea.

Mon'astery M-354, 355–6, *pictures* M-354, F-271. *See also in Index* Monks and monasticism
Russian, Lavra K-39

Monastir, Yugoslavia. *See in Index* Bitolj

Mon'azite sand, a brownish crystalline mineral containing phosphates of several rare earth elements, including thorium and cerium, used in gas mantles, lighter flints, and carbon arcs for searchlights: M-265

Monboddo, James Burnett, Lord (1714–99), Scottish judge, anthropologist, philosopher; theories on man's evolution had similarities to later Darwinism; friend of Samuel Johnson and Robert Burns ('Of the Origin and Progress of Language'; 'Ancient Metaphysics').

Mönch (*mûnκ*) ("the monk"), a peak of the Bernese Alps, in Switzerland (13,465 ft.).

Monck, Charles Stanley, 4th Viscount (1819–94), British statesman, born Ireland; governor general British North America (Canada) 1861–67; played important part in confederation of Canadian provinces into the Dominion, of which he was made first governor general 1867; returned to Ireland 1868.

Monck, George. *See in Index* Monk

Monc'ton, New Brunswick, Canada, city on Petitcodiac River, near Bay of Fundy; pop. 27,334; agricultural region; railroad workshops; woolens, lumber products, clothing, stoves: *maps* C-69, 73
Moncton Bore N-138

Mond, Sir Alfred. *See in Index* Melchett

Monda'min, in Longfellow's 'Song of Hiawatha', personification of Indian corn.

Monday, second day of week; named in honor of moon.

Mondovi (*mŏn-dō'vē*), Italy, city 55 mi. w. of Genoa; pop. 2498; scene of Napoleon's victory over Sardinians (1796): *map* E-425

Mondrian, Piet (1872–1944), Dutch nonobjective painter; worked in France and the United States; noted for geometric compositions of white or colored rectangles and black bars.

Monel metal N-235, C-475, *table* A-174

Monerans (*mō-nẽr'ăns*), in zoology L-225, *pictures* L-224*d*

Mones'sen, Pa., industrial borough 21 mi. s. of Pittsburgh, on Monongahela River; pop. 17,896; steel and sheet and tin-plate products: *map* P-132

Monet (*mō-nĕ'*), **Claude** (1840–1926), French landscape painter, called chief "luminist" of the impressionist movement because he made light the sole problem of painting; first to use "broken colors," placing primary colors on canvas in small patches, side by side, instead of mixing paints on palette ('Haystacks'; 'Cathedrals'; 'Gardens'; 'Lily Pools'; 'Thames Bridge')
impressionism P-31*b–c*: 'Sunflowers' P-31*b*, *color picture* P-31*c*

Moneta (*mō-nē'tä*), a name, meaning good counsel (from Latin *moneo*, "I advise"), given to Juno; also, name of temple built to her.

Monetary Fund, International I-197

Money M-335–40, *pictures* M-335–40, *table* M-339. *See also in Index* Coins and coinage; Paper money
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Monge (*mônzh*), **Gaspard** (1746–1818), French mathematician, born Beaune, France, regarded as inventor of descriptive geometry, helped found Ecole Polytechnique Paris
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Moniz, Egas (born 1874) Portuguese neurologist, served on faculty of medicine, University of Lisbon for developing brain operation known as prefrontal lobotomy he shared the 1949 Nobel prize in medicine and physiology with Walter R Hess
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'Monk, The', a romance by Matthew Gregory Lewis about a monk Ambrosio who becomes very sinful and finally sells his soul to the devil The book was so popular that the author became known as "Monk" Lewis
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Monmouth, or **Monmouthshire,** England, county e of s Wales 546 sq mi, pop 424,647, ironworks part of Wales until 1535, still closely associated with Wales and for some administrative purposes regarded as part of Wales, many inhabitants speak Welsh, county seat is town of Monmouth (pop 5432) *map* E-347
Monmouth, Ill, city in agricultural region 90 mi n w of Springfield, pop 10 193 pottery, furnaces, dairy products, Monmouth College *map* I-36
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Monmouthshire. *See in Index* Monmouth
Monnet (*mô-nĕ'*), **Jean** (born 1888) French economist and diplomat born Cognac, France, appointed Dec 1945 to direct five-year program for modernization and equipment of French industry (Monnet Plan), chief author of Schuman Plan, president of High Authority of European Coal and Steel Community 1952–55
Monocacy (*mo-nok'a-si*), Civil War battle, July 9, 1864, Confederates under Early defeated Union forces under Wallace on Monocacy River in w Maryland near Frederick
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Monomet'alism, a money system which has a single metal as standard usually gold but occasionally silver opposed to bimetallism
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Monongahela (*mō-nŏn-ga-he'la*) **River,** flows 125 mi through West Virginia and Pennsylvania P-274, *maps* P-122, 132, W-100, 106–7, U-265
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Mon'oplane, airplane with one pair of wings A-103
Monop'oly, control of a service or the supply of a commodity, usually includes the power to fix prices M-359–60 *See also in Index* Competition, Government regulation of industry, Trusts industrial
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Monosac'charide, any of several simple sugars having the formula ($C_6H_{12}O_6$), and differing in structure of molecule, none can be split as can more complex sugars, into simpler sugars S-446
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Monro, Harold Edward (1879–1932), Scottish poet and critic, born Brussels Belgium, in 1912 founded Poetry Bookshop, London famous meeting place of poets ('The Collected Poems of Harold Monro')

Monroe, Elizabeth Kortright (1768–1830), wife of President Monroe W-126–7
Monroe, Harriet (1860–1936), American poet M-363, A-230*b*, *picture* M-363
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Monroe, Paul (1869–1947), educator, born North Madison, Ind.; professor of education, Teachers College, Columbia University; educational adviser for China; editor, 'Cyclopedia of Education' ('Text Book in the History of Education').
Monroe, Vaughn (born 1911), composer, singer, band leader, actor, born Akron, Ohio; began as trumpet player, later led own band ('My Devotion'; 'The Last Time I Saw Paris'; 'Racing with the Moon').
Monroe, La., port on Ouachita River, 97 mi. e. of Shreveport; pop. 38,572; cotton raising, farming, lumbering, and large natural-gas distribution; carbon black, lumber products, paper: *maps* L-330, U-253
Monroe, Mich., city 35 mi. s.w. of Detroit on Raisin River, 2 mi. from Lake Erie; pop. 21,467; agricultural region; automobile accessories, lumber, paper, steel; nurseries, fisheries, and limestone quarry; airport; battle of Frenchtown fought here (1813): *map* M-227
Monroe, N. C., city 24 mi. s.e. of Charlotte; pop. 10,140; textiles, brick and tile: *map* N-274
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Monrovia (*mŏn-rō'vĭ-a*), Calif., city 15 mi. s.e. of Los Angeles in foothills of San Gabriel Mountains; pop. 20,186; shipping point for citrus fruits; health center: *map, inset* C-35
Monrovia, seaport and capital of Liberia, Africa; pop. 14,000: L-178, *map* A-46
Mons (*môṅs*), mining and manufacturing city in s.w. Belgium 35 mi. s.w. of Brussels; pop. 25,661; capital of Hainaut Province; important coal fields of Borinage are nearby; iron products, woolen and cotton goods, sugar: *map* B-111
World War I W-220
Monsieur (*mŭs-yû'*) (my lord), French title of polite address to a man.
'Monsieur Beaucaire' (*bō-kêr'*), title and hero of romance by Booth Tarkington; Frenchman of royal blood who poses as a barber in Bath, England.
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Montage (*mŏn-täzh*), in art, use of one or more mounted pictures as integral parts of a composition. *See also in Index* Collage; Photomontage
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Montagnais (*môṅ-tän-yä'*), a group of Indian tribes that live in Quebec, *map* I-106*f*, *table* I-107
Montagu, John. *See in Index* Sandwich, John Montagu
Montagu, (*mŏn'tă-gū*), **Lady Mary Wortley** (1689–1762), English beauty, wit, letter writer, and eccentric; introduced smallpox inoculation into England.
Montague, C(harles) E(dward) (1867–1928), English journalist and novelist; for years on staff of *Manchester Guardian;* noted for liberal views and trenchant style ('A Hind Let Loose'; 'Right Off the Map', social and political fantasies; 'Dramatic Values', criticism).
Montague, in Shakespeare's 'Romeo and Juliet', Romeo's family, at feud with Capulets R-198
Montaigne (*mŏn-tān'*, French *môṅ-tĕn'y'*), **Michel Eyquem de** (1533–92), French essayist M-366, E-397
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Montalembert (*môṅ-tä-läṅ-bĕr'*), **Charles Forbes René de** (1810–70), French publicist and historian; Roman Catholic Liberal leader ('St. Elizabeth of Hungary').
Montalvo (*môn-täl'vō*), **Garcia Ordonez de**, Spanish writer of early 16th century; translated romance of chivalry, 'Amadis of Gaul,' from Portuguese original; his 'Deeds of Esplandian' influenced Spanish search for California: C-25
Montana (*mŏn-tă'na*), state in n.w. U. S.; 147,138 sq. mi.; pop. 591,024; cap. Helena: M-366–78, *maps* M-374–5, 367, 371, U-252, 296, *pictures* M-367–8, 377–8
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Montaña (*môn-tä'nyä*), name applied to mountain districts in Spain and to forested regions of the Andes
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Montana, University of, operates as a single university with six separate units: Eastern Montana College of Education, Montana School of Mines, Montana State College, Montana State University, Northern Montana College, Western Montana College of Education. *See in Index* schools by name
Montana School of Mines, at Butte, Mont.; one of six units of the University of Montana; state control; founded 1893; geology, metallurgy, mineral dressing, mining, petroleum engineering; graduate studies.
Montana State College, at Bozeman, Mont.; one of six units of the University of Montana; state control; founded 1893; agriculture, engineering, household and applied arts, nursing, science; graduate division.
Montana State University, at Missoula, Mont.; one of six units of the University of Montana; state control; opened 1893; arts and sciences, business administration, education, forestry, journalism, law, music, pharmacy; graduate division: *picture* M-377
Montargis (*môṅ-tår-zhē'*), France, town 63 mi. s.e. of Paris; pop. 13,529; famous for "dog of Montargis," said to have revealed master's murderer by constantly following him; Mirabeau born at the Château de Bignon nearby: *map* E-425
Montauk Point, on Long Island, N.Y.; easternmost point of state of New York: *map, inset* N-204–5, *picture* N-208
Mont Blanc, peak of Alps. *See in Index* Blanc, Mont
Montbretia, a genus of plants. *See in Index* Tritonia
Montcalm', Louis Joseph, Marquis de (1712–59), French general M-378

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Mont Cenis Tunnel, in Alps T-209
Montclair, N.J., residential town 7 mi. n. of Newark and 15 mi. n.w. of New York City; pop. 43,927; on first range of Orange Mts.; New Jersey State Teachers College: *map* N-164
Monte (*mŏn'tā*), in South America, a high region having scanty rainfall S-272, *map* S-255
Montebello (*mŏn-tē-bĕl'ō*), Calif., city 7 mi. s.e. of Los Angeles; pop. 21,-735; oil wells and truck farming: *map, inset* C-35
Montebello (*mŏn-tā-bĕl'lō*), village in n. Italy 40 mi. n. of Genoa, where French defeated Austrians 1800 and 1859.
Monte Carlo (*mŏn'tē kär'lō*), town in principality of Monaco; pop. 7967: M-378–9
Monte Cris'to, small barren Italian island in Mediterranean, about 25 mi. s. of Elba; penal colony since 1874. *See also in Index* 'Count of Monte Cristo'
Montefiore (*mŏn-tē-fĭ-ō'rē*), **Sir Moses** (1784–1885), Jewish philanthropist in England; amassed fortune on London stock exchange and after his 43d year devoted all his time to improving condition of Jews, particularly in Russia and Turkey.
Montemezzi (*mŏn-tā-mĕt'sē*), **Italo** (1875–1952), Italian composer, born Vigasio, near Verona, Italy; abandoned study of engineering for musical training at Milan conservatory; married American pianist and lived several years in U.S.; operas characterized by rare melodic beauty and refinement
'L'Amore dei tre re' (The Love of Three Kings), story O-389, *pictures* O-391, 393
Montenegro (*mōn'tā-nā-grō*), **Roberto** (born 1885), Mexican painter M-204
Montenegro (*mŏn-tē-nē'grō*) (Black Mountain), former kingdom of s. Europe on Balkan Peninsula n. of Albania; extends s.w. from Serbia to Adriatic Sea; mountainous, forested; became nation 1389; famed for never really yielding to Turkey; in 1918 became part of Kingdom of Serbs, Croats, and Slovenes (later Yugoslavia); overrun by Germany in World War II; in 1945 became a federal unit of Federal People's Republic of Yugoslavia; 5342 sq. mi.; pop. 419,625; cap. Titograd (traditional cap. Cetinje): Y-346, 347, *maps* A-497, E-425
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Montenotte (*mōn-tā-nôt'tā*), village 25 mi. w. of Genoa, Italy, where Napoleon won first victory (1796), defeating Austrians.
Montereau (*môn-trō'*), France, town on Seine River 45 mi. s.e. of Paris; pop. 8726; near Montereau, Napoleon defeated Allies in 1814.
Monterey (*mŏn-tĕr-ā'*), Calif., resort on Monterey Bay, about 100 mi. s.e. of San Francisco; pop. 16,205; fishing and canning interests; picturesque old Spanish buildings; first capital of California; U. S. Army post: C-38, *maps* C-35, U-252
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peninsula, *picture* C-37
Monterey cypress C-534
Monterey Park, Calif., city 6 mi. n.e. of Los Angeles; pop. 20,395: *map, inset* C-35
Monterey pine, rare evergreen tree (*Pinus radiata*) of pine family, native to s. California coast region and Guadalupe Island, Mexico. Grows 40 ft. to 100 ft. high. Rough dark brown bark; crown round-topped; leaves in threes, to 6 in. long, dark green; cones oval, slightly curved, to 7 in. long, remain on tree for several years.
Monte Rosa (15,217 ft.), Alpine peak S-479, *maps* S-475, I-262
Monterrey (*mōn-tĕr-rā'*), railroad and manufacturing center in n.e. Mexico, capital of Nuevo León state; pop. 331,771; captured by Gen. Zachary Taylor (1846) in Mexican War: M-202, *maps* M-189, M-194–5
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Montesquieu (*môn-tĕsk-yû'*), **Charles Louis de Secondat, baron de** (1689–1755), French political philosopher; called founder of science of comparative politics and philosophy of history; 'Lettres persanes' (Persian letters) satirizes the social, political, religious, and literary follies of his day; 'Esprit des lois' (Spirit of Laws), a lengthy treatise on laws
contributor to 'Encyclopédie' R-88*d*
political theory P-360
Montessori (*môn-tĕs-sō'rē*), **Maria** (1870–1952), Italian educator and psychiatrist M-379
Monteux (*môn-tû'*), **Pierre** (born 1875), French orchestra conductor, born Paris; became American citizen 1942; conductor of Diaghilev's Ballet Russe, of Boston Symphony Orchestra 1919–24, of Paris Symphony Orchestra 1930, of San Francisco Symphony Orchestra 1935–52.
Monteverdi (*môn-tā-vĕr'dē*), or **Monteverde** (*môn-tā-vĕr'dā*), **Claudio** (1567–1643), Italian composer, born Cremona; his innovations, including use of unprepared dissonances, led way to modern music; wrote church music, operas ('Orfeo'; 'Arianna'): O-388
Montevideo (*mŏn-tĭ-vĭd'ĭ-ō*, Spanish *mōn-tā-vē-dā'ō*), capital of Uruguay; pop. 850,000: M-379, U-406, *maps* S-253, U-407, *picture* U-406
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Montezu'ma II (1466–1520), Aztec chief, or "emperor," of Mexico A-542, 543
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Montezuma Castle National Monument, in Arizona N-37, *map* N-18
Montfaucon (*môn-fō-kôn'*), hill 13 mi. n.w. of Verdun, key to German first line in Meuse-Argonne; captured by Americans Sept. 27, 1918.
Mont'fort, Simon de, earl of Leicester (1208?–65), English statesman and soldier M-379
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Montgolfier (*môn-gōlf-yā'*), **Jacques Etienne** (1745–99) and **Joseph Michel** (1740–1810), brothers, French inventors of balloon B-33, *picture* B-28*d*
Montgomery, Bernard Law, first Viscount Montgomery of Alamein (born 1887), British field marshal M-380, *picture* W-271
Montgomery, David (1870–1917), comedian, born St. Joseph, Mo.; associated with Fred Stone 1895–1917 and played in 'Wizard of Oz', 'The Red Mill', 'Chin Chin'; exponent of tap and soft-shoe dancing.
Montgomery, James (1771–1854), British poet; of his 'Wanderer in Switzerland', Byron said it was worth a thousand 'Lyrical Ballads'; humanitarian sentiments inspired his verse; more than 100 hymns by him still in use.
Montgomery, Lucy Maud (Mrs. Ewan Macdonald) (1874–1942), Canadian novelist, born Prince Edward Island C-106*a*
"Green Gables" farmhouse in Prince Edward Island National Park N-38*f*
Montgomery, Richard (1738–75), American soldier, born Ireland; brigadier general in Continental army 1775, with Benedict Arnold led futile attack on Quebec Dec. 31, 1775; killed almost at first shot; Montgomery, Ala., named for him.
Montgomery, Ala., state capital, near center of state on Alabama River; pop. 106,525; Alabama State College for Negroes: M-380, *maps* A-127, U-253
Capitol, State, *picture* A-112
first capital of Confederacy C-433, *picture* A-120: Confederate Congress in session, *picture* C-433*a*
Montgomeryshire, inland county in central Wales; 797 sq. mi.; pop. 48,000; county town Montgomery; climate mild and soil fertile, especially in Severn Valley; here English language is almost unknown.
Montgomery Ward & Co., mail-order house, founded in Chicago by Aaron Montgomery Ward 1872; retail-store system added in middle 1920's.
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Montherlant (*môn-tĕr-län'*), **Henri de** (born 1896), French writer F-289
Montholon (*môn-tō-lôn'*), **Charles Tristan, marquis de** (1783–1853), French soldier, devoted to Napoleon, whom he accompanied to exile at St. Helena; to him Napoleon dictated notes on his career.
Monti (*môn'tē*), **Vincenzo** (1754–1828), Italian poet and dramatist ('Aristodemo'; 'Bassevilliana').
Monticello (*mŏn-tĭ-sĕl'ō*, also *mŏn-tĭ-chĕl'ō*), Thomas Jefferson's home in Virginia J-332*d*, *pictures* J-331–2
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Montmagny, Charles Jacques Huault de (flourished 1622–54), French soldier, governor of New France 1636–48; built fort on Richelieu River to check Iroquois; made peace with Iroquois 1645.
Montmartre (*môn-mär'tr*), section of Paris, France P-81, 84, *map* P-83*a*, *picture* P-85
Montmorency (*môn-mō-rän-sē'*), famous French family of which most distinguished members were **Matthieu II** (1189–1230) called "the Great Constable," a successful warrior; **Anne de Montmorency** (1493–1567), distinguished in wars of Francis I; **Henry II, duc de Montmorency** (1595–1632), admiral of France and viceroy of Canada, successfully fought against Huguenots, but executed for treason through influence of Richelieu. Two members of family, the duke of Montmorency-Laval and his father, fought in American Revolution.
Montmorency, François Xavier de Laval. *See in Index* Laval-Montmorency
Montmorency, Falls of, Canada, beautiful cascade over 250 ft. high in

Montmorency River at confluence with St. Lawrence near Quebec.
Montparnasse (*mōn-pär-näs'*), section of Paris; site of famous Dôme Café and other centers of artistic, literary, and Bohemian life: *map* P-83*a*
Montpelier (*mŏnt-pēl'yẽr*), Vt., state capital, on Winooski River M-380, *maps* V-457, U-253
Capitol, State M-380, *picture* V-462
Montpelier, home of James Madison in Virginia, about 20 mi. n.e. of Charlottesville; Madison lived most of life there except when away on official duties.
Montpellier (*mōṅ-pĕl-yā'*), city in s. France 6 mi. from Mediterranean; pop. 80,673; noted university; large trade in wine, fruit, and silk; makes soap, candles, leather, distilled liquors: *maps* F-259, E-425
Montreal (*mŏn-trē-ạl'*), Quebec, Canada; pop. 1,021,520: M-380–1, *maps* C-72, *inset* C-69, *pictures* M-381, C-65
American Revolution R-128
Cartier C-130, C-95*a*
early fur trade L-104
early history C-95*a*, M-380–1
Harbor Bridge. *See in Index* Bridge, *table*
Montreal Botanical Garden B-262
Montreal, University of (Université de Montréal), at Montreal, Quebec, Canada; Roman Catholic; founded 1876 as branch of Laval University; practically independent after 1889; present name from 1919; arts, dental surgery, law, letters, medicine, optometry, pharmacy, philosophy, sciences, social, economic, and political sciences, public health, theology; graduate school; affiliated schools; teaching in French.
Montreal Botanical Garden, in Montreal, Canada; established 1932 by city of Montreal; 260 acres: B-262
Montreux (*mōṅ'trû*), resort on e. bank of Lake Geneva, Switzerland; pop. 17,424: G-36, *map* S-475
Montreux (*mōṅ-trû'*), **Treaty of** (1936), signed by the members of League of Nations authorizing Turkey to fortify the Dardanelles and to close them if Turkey should be at war; guaranteed free commerce through the Dardanelles in peace, and in war if authorized by the League.
Montrose', James, duke of (died 1742), Scottish leader, favored union of Scotland and England; regent of kingdom on death of Queen Anne
Rob Roy R-166
Montrose, James Graham, marquis of (1612–50), Scottish Jacobite general; signed Covenant of 1637 but believed in subordination of church to state; joined Royalists 1640, and won many victories against Covenanters; except Cromwell greatest soldier of Civil War; betrayed, imprisoned, hanged as a traitor by order of Scottish parliament; wrote many poems (celebrated lyric, 'My Dear and Only Love').
Monts (*mōṅ*), **Pierre du Guast, comte de** (1560–1611), French courtier, founder of Acadia; called the sieur de Monts; sent out expedition under Champlain which founded Quebec
Port Royal, Nova Scotia C-95*a*, N-39
Saint John River N-138*b*
Mont Saint-Michel (*mōṅ săṅ-mē-shēl'*) (St. Michael's Mount), rocky island of n.w. France a mile off coast of Normandy, with which it is connected by a causeway; famous for abbey-fortress, fine example of medieval Gothic architecture: *picture* F-271
Montsec (*mōṅ-sĕk'*), an isolated height 8 mi. e. of Saint-Mihiel; captured by Americans Sept. 12, 1918, in Saint-Mihiel offensive: *picture-map* W-233
trenches, *picture* W-226
Montserrat (*mŏnt-sĕ-răt'*), in British West Indies, one of Leeward Islands; 32 sq. mi.; pop. 14,333, mostly Negroes; Soufrière, an active volcano: *map* W-96*a*
Montserrat, mountain 30 mi. n.w. of Barcelona, Spain; vast fissure, dividing it, said to have occurred at time of Crucifixion; monastery, in medieval legend the castle of the Holy Grail, visited by thousands.
Montt (*mŏnt*), **Manuel** (1809–80), Chilean statesman, president 1851–61; established modern communications, schools, and banks.
Monulph, Saint (6th century), bishop of Tongres
founds Liége L-222
Monumental City, Baltimore, Md. B-41
Monuments, national, in U. S. N-30–8*d*, *map* N-18. *See also* Fact Summary with each state article
Monvel, Louis Maurice Boutet de. *See in Index* Boutet de Monvel
Mood, or mode, of verb V-449–50
Moodie, Mrs. Susanna (1803–85), Canadian author; wrote poems and novels of Canadian life: C-105
Moody, Dwight Lyman (1837–99), American evangelist M-381
Moody, William Vaughn (1869–1910), poet and dramatist, born Spencer, Ind.; taught English at University of Chicago; famous poems are 'Gloucester Moors' and 'Ode in Time of Hesitation' ('The Great Divide', play; 'The Masque of Judgment' and 'The Fire-Bringer', poetic dramas): A-230*b*
Moody Bible Institute, an interdenominational, evangelistic organization, founded in Chicago 1889; trains pastors, missionaries, other Christian workers; publishes *Moody Monthly*, evangelical books and pamphlets; produces gospel-science films; operates radio station
Moody, Dwight L., founder M-381
Mook, Hubertus J. van (born 1894), Dutch statesman, born Java; lieutenant governor general of the Netherlands Indies 1942–48, formerly director of economic affairs.
Mooltan, Pakistan. *See in Index* Multan
Moon, Grace Purdie (1883–1947), author of Pueblo Indian tales for children; born Indianapolis, Ind. ('Indian Legends in Rhyme').
Moon M-382–9, A-431, *pictures* M-382–3, 385–8
curious facts and superstitions M-388–9: symbol of inconstancy M-384
distance from earth M-382
eclipse E-210, M-388, 384: Baily's beads M-382
gravity M-384, N-193
longitude calculations L-313
lunar month M-380, M-387
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motion A-431
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phases A-431, *diagram* M-385
precession of equinoxes A-440, *diagram* A-441
radar contact with R-28
rainbow, lunar R-70, M-389
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tides T-129–31, M-382, *pictures* T-130–1
travel to S-309–10, D-100–1, *diagram* D-101, *pictures* S-309–309*f*
weight, *picture* M-382
Moon, Mountains of the, name given in ancient geography to African range identified in part with Ruwenzori chain A-37
fabled source of White Nile N-238
Moondogs M-389. *See also in Index* Sundogs
Mooney, Edward, Cardinal (born 1882), Roman Catholic prelate, born Mt. Savage, Md.; bishop of Rochester, N. Y., 1933–37; archbishop of Detroit 1937–46; created cardinal 1946.
Mooney, Thomas J. (1882?–1942), American labor agitator, sentenced to death and later to life imprisonment for bombing in San Francisco 1916; pardoned 1939: C-49
Mooney, William (1756–1831), organizer of Tammany Society T-9
Mooneye, name for shadlike, fresh-water fishes (family *Hiodontidae*), notably *Hiodon tergisus* of Mo.-Miss. Valley and Great Lakes and Hudson Bay regions. Teeth strong. Good sport fish, but seldom eaten.
Moonfish, a small bright and silvery fish (*Platypoecilus maculatus*), with a greatly compressed and distorted body; common on the South Atlantic coast of U. S. Also a less common fish (*Lampris regius*) of large size and gorgeous coloration —a rich brocade of silver and lilac with vermilion jaws and fins—sometimes called opah and mariposa; delicious flavor: A-281
Moonflower, a climbing garden plant (*Ipomoea* or *Calonyction*) closely related to the morning-glory; has very smooth stems with soft, almost prickly, projections; leaves heart-shaped; large white or purple, fragrant flowers open in the evening and close before noon the next day.
Moon-goddess, in Greek mythology A-389, H-328. *See also in Index* Artemis
Moonlight schools, schools for adult illiterates held originally on moonlight nights by volunteer teachers; first founded in Kentucky by Cora Wilson Stewart in 1911; later in other states.
'Moonlight Sonata', musical composition by Beethoven 1802, forming the second sonata of Opus 27, C Sharp Minor; Beethoven called it 'Sonata quasi una fantasia'. The first movement reminded a critic of moonlight on Lake Lucerne; hence the title 'Moonlight Sonata'
motion picture P-19*a*
Moon shell (*Natica canrena*), mollusk shell, *color picture* S-140
Moonstone, a semiprecious stone J-350
Moonwort. *See in Index* Lunaria
Moor, Emanuel (1863–1931), pianist and composer, born Kecskemet, Hungary
inventor of double-keyboard piano P-250
Moor, wasteland
England E-348
swamp and sphagnum moors W-67
Moore, Anne Carroll (born 1871), American librarian and critic; superintendent of work with children, New York Public Library, 1906–41; lecturer and writer on children's books ('My Roads to Childhood'; 'The Three Owls').
Moore, Clement Clarke (1779–1863), poet and educator, born New York City; professor General Theological Seminary, New York (1821–50), compiled a 'Hebrew and English Lexicon'; remembered for poem 'A Visit from St. Nicholas', beginning

with the words, "'Twas the night before Christmas": S-43

Moore, Douglas (Stuart) (born 1893), composer and educator, born Cutchogue, N.Y.; joined faculty Columbia University 1926, head of music department since 1940; won Pulitzer prize (1951) for music for opera 'Giants in the Earth' based on Rolvaag's novel; elected to American Academy of Arts and Letters 1951; wrote textbooks on music ('Listening to Music' and 'From Madrigal to Modern Music').

Moore, Mrs. Frederick F. *See in Index* Gates, Eleanor

Moore, George (1852–1933), Irish novelist and dramatist; follower of French school of realism; highly individualistic work ('The Brook Kerith', 'Héloïse and Abélard', novels; 'Ave', 'Salve', and 'Vale', autobiographical trilogy entitled 'Hail and Farewell'): E-380

Moore, Grace (1901–47), soprano, born Slabtown, near Del Rio, Tenn.; moved to Jellico at age of 5; debut Metropolitan Opera, N. Y. City, 1928; popular in musical films; killed in airplane accident, Copenhagen, Denmark (famous opera roles, in 'La Bohème' and 'Louise').

Moore, Henry (born 1898), English modernist sculptor, born near Leeds, England; contends that the third-dimensional effect is increased by the fissures, craters, and holes he often employs in his sculptured shapes
- 'Family Group', *picture* A-400*i*
- 'Madonna and Child' S-73–4, *picture* S-73

Moore, James (died 1706), governor of Carolina; active in colonial politics and in Indian trade; became governor in 1700.

Moore, Sir John (1761–1809), British general, commander in Spain against Napoleon at Coruña; killed in moment of victory; buried in ramparts, as described in Charles Wolfe's poem 'The Burial of Sir John Moore'.

Moore, John Bassett (1860–1947), jurist, born Smyrna, Del.; professor international law and diplomacy, Columbia University, 1891–1924, with frequent leaves of absence to serve on national and international commissions; judge Permanent Court of International Justice 1921–28.

Moore, Marianne Craig (born 1887), poet, born St. Louis, Mo.; acting editor *The Dial* 1925–29; awarded Pulitzer prize 1952 for 'Collected Poems' ('Selected Poems'; 'The Pangolin, and Other Verse'; 'What Are Years'; 'Nevertheless').

Moore, Richard B. (1871–1931), chemist, born Cincinnati, Ohio; dean of science and head of chemistry department, Purdue University; chemist and metallurgist in government service; one of first workers in field of radioactivity; first to prepare radium in U.S.

Moore, Thomas (1779–1852), Irish poet and song writer, born Dublin; very popular in his day, especially for 'Lalla Rookh', an oriental verse romance; now best known for many lyrics set to music, such as 'The Last Rose of Summer' and 'Oft in the Stilly Night'; his life of Byron source of later biographies: E-380

Moorea (*mō-ō-rā'a*), one of Society Islands in s. Pacific; 50 sq. mi.; pop. 2848; phosphate, copra: *map* P-17

Moore House, at Yorktown, Va., *picture* N-32

Moores Creek, a small stream in North Carolina flowing into Cape Fear River; on its banks, about 18 mi. n.w. of Wilmington, a battle of the American Revolution was fought, Feb. 27, 1776, in which the Americans were victorious; made national military park 1926.

Moorfowl, or red grouse, the British grouse G-221

Moorhead, Minn., town on Red River, opposite Fargo, N. D.; pop. 14,870; center of dairying, wheat- and potato-growing area; Concordia College, State Teachers College: *maps* M-286, U-253

Mooring mast, for dirigibles, *pictures* B-32, 36

Moorish architecture, a form of Mohammedan architecture, *Reference-Outline* A-325
- Alhambra A-167, *picture* S-321
- Giralda, bell tower in Seville, *picture* S-109

Moorish idol, or sickle fish, handsome fish (*Zanclus cornutus*) found throughout the warm waters of the Pacific. The skin is a fine shagreen, the dorsal spines are prolonged, and the color is yellow crossed by bars of black; related to the angel fishes.

Moorland, land made up of moors. *See in Index* Moor

Moors, mixed Berber-Arabian people of n. Africa M-389
- architecture. *See in Index* Moorish architecture
- civilization M-331–2
- Gaul F-259
- Morocco M-394
- Spain S-320–1, M-389: pottery P-396*a*–*b*
- Ximenes attempts to convert X-328

Moose M-389–91, *picture* M-390, *color picture* M-262
- European elk similar E-334*b*–5
- length of life, *pictograph* A-249
- prehistoric, *picture* P-407
- zoo, not in Z-359

Moose, Loyal Order of, a secret, beneficiary, fraternal society, founded in 1888 at Louisville, Ky. Sick and funeral benefits are paid, and a home and vocational school for dependents and orphans of members is maintained at Mooseheart, near Aurora, Ill.

Moose elm E-335

Moosehead Lake, irregular lake near center of Maine, largest in state; 35 mi. long; 115 sq. mi.; outlet, Kennebec River: *maps* M-46, 52

Mooseheart Home and School, Mooseheart, Ill., founded by James John Davis. *See in Index* Moose, Loyal Order of

Moose Jaw, Saskatchewan, Canada, industrial, railroad, and grain center 40 mi. w. of Regina; pop. 24,355; flour, lumber, packing-house products: *maps* C-68, 81

Moose Mountain, wooded region in Saskatchewan, Canada S-46

Moose River, Ontario, Canada, flowing into James Bay; 340 mi. long from head of main tributary, the Mattagami, to mouth; other tributaries are the Abitibi and the Missinaibi: *map* C-72

Moosewood. *See in Index* Striped maple

Moosonee, Ontario, Canada, railroad terminus and trading post of Hudson's Bay Company on James Bay at mouth of Moose River; pop. 300: *maps* C-69, 72
- railroad C-83

Moraceae. *See in Index* Mulberry family

Moradabad (*mō-rä'dä-bäd*), or **Muradabad**, India, city in Uttar Pradesh state; pop. 161,854; railroad center; has important brassware industry; contains a great mosque built in 1631: *map* A-407

Moraea (*mō-rē'a*), a genus of the Iris family I-232

Moraine (*mō-rān'*), a rock belt formed by a glacier G-116, I-4, 5

Moral'ities, or morality plays, allegorical plays of Middle Ages D-131–2, D-14*e*

Moral Re-Armament Groups (M.R.A.). *See in Index* Buchmanism

Moran (*mō-rän'*), **Thomas** (1837–1926), American etcher, illustrator, and landscape painter, born Bolton, Lancashire, England ('Grand Cañon of the Yellowstone').

Morand (*mô-räṅ'*), **Paul** (born 1888), French novelist; in diplomatic service in various parts of world; colorful stories and travel books ('Open All Night'; 'Nothing but the Earth'; 'Black Magic'; 'Indian Air').

Morat (*mô-ra'*), town in w. Switzerland 15 mi. w. of Bern; pop. 2405; scene of battle (1476) in which the Swiss defeated Charles the Bold, duke of Burgundy: C-195

Moratín (*mō-rä-tēn'*), **Leandro Fernández de** (1760–1828), Spanish dramatist and poet; strongly influenced by Molière ('El sí de las niñas').

Morator'ium, legal extension of time for payment of debts or obligation reparations and war debts H-421, 423, W-243, *picture* W-244
- U. S. banks (1933) R-204

Morava (*mô'rä-vä*), **River**, German **March** (*märk*), Czechoslovakia, about 200 mi. long, rises in Sudeten Mountains, flows s. through Moravia, then forms part of boundary between Slovakia and Austria before emptying into the Danube w. of Bratislava: *maps* C-535, G-88

Morava (*mō'rä-vä*) **River**, Yugoslavia, about 100 mi. long, formed by junction of the Southern Morava and Western Morava, flows n. into the Danube e. of Belgrade (Beograd): *map* E-417

Mora'via, province of Czechoslovakia; more than 10,000 sq. mi.; pop. 3,500,000 (before World War II): C-535, 536, *maps* A-497, C-535, E-425

Moravian College, at Bethlehem, Pa.; Moravian; for men; founded 1807; arts and sciences, business administration, education; graduate professional school of theology.

Moravians, or United Brethren, Christian denomination which arose in Bohemia and Moravia among followers of John Huss
- missionary work C-304
- settle in Georgia G-79
- settle in Pennsylvania P-138
- Wesley influenced by W-92

Moravska Ostrava (*mō'räf-skä ōs'trä-vä*), city in n. e. Moravia, Czechoslovakia; pop. 171,064; coal, pig iron, metal products: *map* C-535

Moray, earl of. *See in Index* Murray, James Stuart, earl of

Moray Firth, large bay on n.e. coast of Scotland; Caledonian Canal terminus: *maps* B-321, 324

Morays, great family of fierce eellike fishes (*Murenidae*), with strong bodies and doglike mouths with highly developed teeth; found in all tropical seas; some are good food fish, but others poisonous; greatly feared by the native divers: E-268, *picture* F-102
- butterfly fish and F-105
- enemy of octopus O-338

Morchella esculenta (*môr-kĕl'a ĕs'kū-lĕnt-a*), a morel, an edible species M-457, *color picture* M-456

Mor'dant, a biting substance, particularly one used to fix dye or for purposes of etching
alum A-181
dyeing D-165
etching E-387
Mordecai (*môr'dē-kī*), in Bible, cousin of Esther E-399–400
Mordkin (*môrd'kĕn*), **Mikhail** (1881–1944), ballet dancer and choreographer, born Moscow, Russia; entered Moscow Imperial Ballet School at 9; danced with Pavlova and was also a member of Diaghilev's ballet; came to America 1922, appeared with own company.
Mordvinoff, Nicolas (born 1911), pen name Nicolas, artist, born St. Petersburg (now Leningrad), Russia; escaped to Finland at age of 6; spent youth in Paris; lived 13 years in South Pacific. Illustrated 'Thunder Island', written by W. S. Stone, and 'The Two Reds' and 'Finders Keepers', both by William Lipkind. Mordvinoff was awarded the Caldecott medal 1952 for his illustrations in 'Finders Keepers'.
More, Hannah (1745–1833), English writer of verse and of plays and books on moral and religious subjects; later years devoted to philanthropy and popular education ('Coelebs in Search of a Wife'; 'Practical Piety'; 'Moral Sketches').
More, Paul Elmer (1864–1937), essayist, critic, and editor; born St. Louis, Mo.; associate in Sanskrit and classical literature, Bryn Mawr College 1895–97; literary editor, *Independent* and the *New York Evening Post*; editor, *Nation* 1909–14 ('Shelburne Essays'; 'Nietzsche'; 'Life of Benjamin Franklin'; 'The Religion of Plato').
More, Sir Thomas, Saint (1478–1535), English statesman and scholar M-391–2, *picture* M-392
Morea (*mō-rē'ą*), modern name of s. Greece, the ancient Peloponnesus G-188
Moreau (*mô-rō'*), **Jean Victor Marie** (1763–1813), French Revolutionary general; victor of Hohenlinden 1800; exiled for alleged conspiracy against Napoleon; joined Allies against Napoleon 1813; killed on battlefield of Dresden.
Moreau River, S. D., tributary of the Missouri, 200 mi. long: *maps* S-296, 302
Morehead State College, at Morehead, Ky.; opened 1923; education, liberal arts, nursing; graduate work in education.
Morehouse College, at Atlanta, Ga.; affiliated with Atlanta University as undergraduate college for Negro men; Baptist; founded 1867; arts and sciences; graduate school of religion. *See also in Index* Atlanta University
Morel', common name of genus *Morchella,* a group of edible mushrooms: M-457, *picture* M-457. *See also in Index* Morchella esculenta
Morelia (*mō-räl'yä*), Mexico, formerly Valladolid, city 130 mi. n.w. of Mexico City; capital of Michoacán; named for patriot Morelos; pop. 63,248; textiles, sugar, sweetmeats: *maps* M-189, 194–5
university M-204
Morelos (*mō-rā'lōs*), **José María** (1765–1815), Mexican revolutionist; city of Morelia and state of Morelos named for: M-206
Morelos, Mexico, state in s. center; 1916 sq. mi.; pop. 272,952; cap. Cuernavaca: *map* M-195
ejidos M-200
Morelos Dam, in Mexico C-415
Morenci, Ariz., in Greenlee County, 108 mi. n.e. of Tucson; pop. 6541: *map* A-353
Morendo. *See in Index* Music, *table* of musical terms and forms
Morès (*mô-rās'*), **Antoine Amédée Marie Vincent Manca de Vallombrosa, marquis de** (1855–96), French adventurer; farmed in North Dakota; explored in Tibet; killed in Africa by Tuaregs
in North Dakota N-293
Moresby, L. *See in Index* Beck, L. Adams
"More sinned against than sinning" K-46
Moresnet (*mō-rā-nē'*), small territory 4 mi. s.w. of Aachen, near Eupen and Malmedy; neutral territory 1815–1919; ceded to Belgium 1919; taken by Germany 1940; restored to Belgium 1944.
Morey, Samuel (1762–1843), inventor, born Hebron, Conn.; lived chiefly in Vermont; an early inventor of the steamboat; failure of his capitalist backers halted his enterprises and prevented his receiving the honors which later went to Robert Fulton.
Morgagni (*mōr-gä'nyē*), **Giovanni Battista** (1682–1771), Italian anatomist, born Forli in Romagna; regarded as founder of pathological anatomy.
Morgan, Charles (Langbridge) (born 1894), English novelist and critic, born Kent, England; drama critic *The Times,* London, 1921–39 (novels: 'Portrait in a Mirror', 'The Fountain', 'The Voyage', 'River Line', and 'Breeze of Morning'; essays: 'Reflections in a Mirror'; play: 'The Burning Glass').
Morgan, Daniel (1736–1802), American Revolutionary War general, born New Jersey; given command company of Virginia riflemen, 1775; distinguished himself in Arnold's expedition against Quebec, in battles of Saratoga, and at Cowpens
victory at Cowpens R-128*b*
Morgan, Sir Henry (1635?–88), Welsh buccaneer; commissioned by the governor of Jamaica to take Spanish possessions, he ravaged the coast of Cuba and captured the city of Panama; was arrested and returned to England for fighting after peace had been arranged between Spain and England, but his immense stolen wealth gained his pardon; knighted and returned to Jamaica as lieutenant governor
Panama City remains, *picture* P-51
Morgan, John Hunt (1825–64), American Confederate general, daring and famous cavalry raider
raids Kentucky, Indiana, and Ohio C-336
Morgan, John Pierpont (1837–1913), American banker, financier, and art collector, born Hartford, Conn.; leader in movement by which industry was stabilized and subordinated to finance; made J. P. Morgan & Co. one of world's most powerful banking houses, organized U. S. Steel Co., controlled many railroads: M-19
morganite named for J-350
Morgan, John Pierpont (1867–1943), banker and financier, son of the preceding, born Irvington, N.Y.; succeeded to control of his father's banking business, which became incorporated state bank 1940; during World War I, British government's commercial agent in U. S. Pierpont Morgan library. *See in Index* Pierpont Morgan Library
Morgan, John Tyler (1824–1907), U. S. senator from Alabama 1877 to his death, born Athens, Tenn.; enlisted 1861 in Confederate army, brigadier general 1863; member of board (1892) to arbitrate Bering fisheries dispute and of commission (1898) to codify Hawaiian laws.
Morgan, Lewis Henry (1818–81), archaeologist and ethnologist, born near Aurora, N. Y. ('League of the Ho-dé-no-sau-nee, or Iroquois'; 'Ancient Society'); bequeathed fund to found women's college in University of Rochester.
Morgan, Thomas Hunt (1866–1945), zoologist, born Lexington, Ky.; professor, Columbia University 1904–28; director of biological laboratories, California Institute of Technology; wrote books on embryology, evolution, and heredity; Nobel prize in medicine 1933
heredity experiments H-346
Morgan & Co., J. P., bank B-50
Morganat'ic marriage, marriage of a member of a royal family to a woman of lesser rank; not unusual in European court circles; neither wife nor children receive royal rank and title.
Morgan Horse, a breed developed in New England for general utility and founded on the horse Justin Morgan H-428*f*, *picture* H-428*c*, *table* H-428*e*
Morganite, a rose-colored variety of beryl J-350
Morgan le Fay. *See in Index* Fata Morgana
Morgan State College, at Baltimore, Md.; state control; founded 1867; present name 1939; arts and sciences.
Morgantown, W. Va., industrial city near n. boundary, on Monongahela River; pop. 25,525; coal, oil, glass-sand, and limestone nearby; textiles, machine shop, wood, and glass products: *map* W-107
state university, *picture* W-110
Morgarten (*môr'gär-tĕn*), hill in n. Switzerland, 18 mi. s. of Zurich, where Swiss mountaineers defeated Austrians (1315)
battle S-482
Mor'genthau, Henry (1856–1946), American diplomat, born Germany; ambassador to Turkey 1913–16; in charge of interests of Allies in Turkey during World War I; nominated ambassador to Mexico in 1920, but did not go on account of revolution.
Morgenthau, Henry, Jr. (born 1891), public official, publisher, born New York City; son of the above; publisher of *American Agriculturist* 1922–33; governor Farm Credit Administration 1933; secretary of the treasury in President F. D. Roosevelt's Cabinet 1934–45.
Morghen (*môr'gĕn*), **Raffaello** (1758–1833), Italian engraver; copied paintings by Leonardo da Vinci, Raphael, and other masters.
Morgue, name given to newspaper library N-192
Morin (*mô-răn'*), **Paul** (born 1889), Canadian poet ('Le Paon d'émail'; 'Poèmes de cendre et d'or'); poems show oriental influence: C-106
Mo'rion, name applied to black smoky quartz or cairngorm.
Moris'cos (little Moors), Mohammedans in Spain who accepted baptism, and their descendants M-389
Morison, Samuel Eliot (born 1887), historian, born Boston, Mass.; professor of history Harvard University 1925–55 ('Admiral of the Ocean Sea', life of Columbus, Pulitzer prize in biography 1943; 'History of United States Naval Operations in World War II', series).

Morisot (*mo-re-sō'*) **Berthe** (Madame Eugène Manet) (1841–95), painter, great-granddaughter of Fragonard and sister-in-law and pupil of Édouard Manet, her work has a distinctly "feminine touch

Morland, George (1763–1804) English painter of animals and rustic scenes many of his best paintings are familiar through engraved copies

Morley, Christopher (Darlington) (born 1890) writer born Haverford Pa charming informal essays ('Shandygaff') verse particularly in praise of domesticity ('Songs for a Little House'), novels in which fantasy, satire and whimsical humor are variously blended ('Where the Blue Begins', 'Thunder on the Left'), more realistic novels ('Human Being', 'Kitty Foyle'), conductor of column 'The Bowling Green'

Morley, Edward William (1838–1923), chemist and writer on physics born Newark, N J
Michelson-Morley experiment M-215, *R-98, 99*

Morley, Henry (1822–94), English writer and educator born London professor of English language and literature University College London 1865–89, edited many classics and made valuable contribution popularizing good books ('English Writers', 10 vols)

Morley, Thomas (1557–1603), English musician, one of greatest Elizabethan composers, organist at St Paul's Cathedral author of treatise on church music, composed madrigals canzonets, ballets, wrote 'Plaine and Easie Introduction to Practicall Musicke', which remained an authority for more than a century

Morley of Blackburn, John Morley, first Viscount (1838–1923), English statesman and writer, for 25 years a Liberal in House of Commons, secretary for Ireland under Gladstone and for India under Campbell-Bannerman and Asquith wrote lives of Gladstone, Burke, Cobden Cromwell Voltaire, Rousseau, and his own 'Recollections', general editor for 'English Men of Letters' series

Mormon cricket, an insect (*Anabrus simplex*) of the order *Orthoptera*, family *Tettigoniidae*, body 1¼ in long, color green, black, red, or brown, migrates in groups, invades cultivated areas of W U S and does great damage, methods of control poisoning by use of arsenical dust and trapping by means of pits and barriers also called western cricket, or western grasshopper G-168*b*, C-513, *pictures* I-153, 157, C-512
plague in Utah G-230, C-513, U-410

Mormons, or Latter-day Saints, religious body M-392–3
Arizona A-346
'Book of Mormon' M-392
Edmunds Act A-391
Idaho I-23
irrigation works U-408, 409
Nevada N-126
temple *picture* U-419
Utah U-408, 409, 410, 419: monument to gulls G-230, Salt Lake City S-31–2, *picture* S-32
Wyoming W-326
Young, Brigham, leads Y-341*b*

Mormon Trail, early overland route to Salt Lake City F-40, *map* R-159

Morning-glory M-393
wild M-393, *color picture* F-180

Morning-glory family. *See in Index* Convolvulaceae

Morning Glory Pool, in Yellowstone National Park Y-338

Morningside College, at Sioux City, Iowa Methodist founded 1894, arts and sciences, music

Morningside Heights, New York City N-222

Morning star, name given to the planet Venus when it rises before the sun and is plainly seen in the sky just before dawn, sometimes applied also to other planets—Jupiter, Mars Saturn and Mercury

Morning Star of Song C-200

Morning Star of the Reformation W-314

Morocco sultanate in n w Africa, area about 174 900 sq mi, pop 9 345 985, divided into three zones French Spanish and Tangier M-393–4, *maps* A-167, A-46, *pictures* M-394 *See also in Index* French Morocco, Spanish Morocco, Tangier
Decatur conquers pirates D-28
flags F-136*d*, *color picture* F-134
Middle Ages F-136*d*, *color picture* F-133
Moors M 389

Morocco leather L-150, M-394

Mo'ron, a mentally deficient person M-172

Moronidae (*mo-rŏn'ĭ-de*), family of fishes B-77

Moros, Moslem people of mixed Malayan stock in Philippines P-194, *picture* P-197

Morot (*mō-rō'*) **Aime Nicolas** (1850–1913), French historical and portrait painter, portraits of members of fashionable and artistic world of Paris battle scenes
'Charge of the Cuirassiers', *picture* F-268

Morotai (*mō-rō-ta'ē*) mountainous island in the Moluccas Indonesia, 12 mi n e of Halmahera, about 650 sq mi, naval air base occupied by American forces Sept 1944 *maps* E-203, P-16

Morpheus (*mor'fūs*, also *mor'fe-ŭs*), in Roman mythology, dream god, son of Somnus (sleep)

Morphine, a bitter crystalline narcotic alkaloid ($C_{17}H_{19}NO_3$), the active drug in opium and dangerously habit-forming
poisoning treatment for P-341

Morphology, in language L-98*a*

Morphology, the science dealing with the form and structure of living organisms A-239 *See also in Index* Anatomy *subhead* comparative
plant B-262

Morrice dance *See in Index* Morris dance

Mor'rill Justin Smith (1810–98), legislator born Strafford Vt, member U S House of Representatives 1855–67 U S senator 1867–98, author of Morrill Acts A-64

Morrill Acts, in U S A-64, E-256, I-163, U-403

Morris, Charles (1784–1856) American Navy officer who commanded the *Constitution* in battle with *Guerriere*, 1819 commander of South American squadron, later superintendent of Naval Academy

Morris, Clara (1848–1925), American emotional actress (Camille, Alixe, Lady Macbeth), after retiring from stage wrote about stage life, author of several novels and stories

Morris, Gouverneur (1752–1816), statesman born New York, aristocrat by training and temperament, but ardent supporter of Revolution because he believed in its justice, as assistant to Robert Morris 1781–85 proposed decimal system of coinage and words *dollar* and *cent*, member of Constitutional Convention 1787, where he vigorously advocated a strong national government signed United States Constitution for Pennsylvania, much of later life spent abroad, two years as ambassador to France, U S senator from New York 1800–1803, chairman of board 1810–16 which planned Erie Canal
Constitution revised by U-344
Department of Commerce U-365

Morris, Gouverneur (1876–1953), writer of novels and short stories born New York City, great-grandson of above ('If You Touch Them They Vanish' 'His Daughter', 'Yellow Men and Gold')

Morris, Lewis (1726–98), signer of Declaration of Independence as New York delegate, born Morrisiana N Y, brother of Gouverneur Morris the statesman
signature reproduced D-37

Morris, Robert (1734–1806) financier of American Revolution M-395
charters brig *Nancy* W-143
signature reproduced D-37

Morris, William *(1834–96), English* poet artist and social reformer M-395, E-380*b*
quoted M-395, E-369*e*
Trinity Church windows B-258
typography T-230, *picture* B-238: golden type example B-235

Morris Brown College, at Atlanta, Ga, African Methodist Episcopal for Negroes founded 1881 first instruction 1885, arts and sciences business education, religion *See also in Index* Atlanta University

Morris Canal, extended from mouth of Lehigh River at Easton, Pa, to New York City harbor, completed 1832 *map* C-108

Morris dance, or Morrice dance, old English dance of Moorish origin, became part of all village festivities in reign of Henry VIII, usually danced by five men and a boy dressed as Maid Marian, gay costumes with bells abolished by Puritans *picture* F-192*b*

Morrison, Herbert Stanley (born 1888), British political leader, born near London, secretary London Labor party 1915–47, member of Parliament after 1935, home secretary 1940–45, deputy prime minister, president of council, and leader of House of Commons July 1945–51, deputy prime minister and foreign minister 1951–52

Morrison, Robert (1782–1834), English missionary to China C-280

Morrison, Mount, also **Niitakayama** (*nē-ē-ta-ka-ya'ma*), highest mountain in Formosa (12 959 ft), *map* C-259

Morris Plan Bank, a system of industrial banking founded by Arthur J Morris in 1910, makes loans at reasonable rates of interest to responsible people of low income

Morristown, N J, residential town 17 mi n w of Newark in rich farming district, pop 17,124, State Insane Hospital 4 mi away, shaft for first steamship to cross Atlantic was cast here, and Morse and Vail worked on electric telegraph, George Washington's winter quarters (1776–77) *map* N-164
national historical park N-37, *map* N-18

Morristown, Tenn, city 40 mi n e of Knoxville, pop. 13,019, burley tobacco and general farming, boats, rayon, furniture, Morristown Normal and Industrial College· *map* T-67

Mor'ro, El, fort at entrance to harbor of San Juan Puerto Rico P-434–5

Morro Castle, fort at entrance to harbor of Havana, Cuba; built in late 16th century by Spanish colonists as a protection against French, English, and Dutch buccaneers; also used as a prison; guns last fired during Spanish-American War; now a popular tourist sight.

Morro Velho, a Brazilian gold mine, noted for its depth (6126 feet).

Morrow, Dwight Whitney (1873–1931), diplomat and statesman, born Huntington, W. Va.; practiced law in New York; member J. P. Morgan & Co.; resigned 1927 to accept appointment as ambassador to Mexico; elected U. S. senator from New Jersey 1931; His daughter Anne married Charles A. Lindbergh
 Mexican friendship won M-208, L-107

Morrow, Elizabeth Reeve Cutter (1873–1955), author, born Cleveland, Ohio; married Dwight Whitney Morrow; acting president of Smith College 1939–40; author of 'Painted Pig', 'Beast, Bird and Fish', 'Quatrains for My Daughter'.

Morrow, Honoré Willsie (McCue) (1880–1940), writer, born Ottumwa, Iowa; editor of *Delineator* 1914–19; known especially for historical novels ('Forever Free', 'With Malice Toward None', 'The Last Full Measure'—trilogy on Lincoln; 'Still Jim'; 'On to Oregon').

Mors, in Roman mythology, god of death, corresponding to Greek Thanatos.

Morse, Samuel Finley Breese (1791–1872), American artist and inventor of the electric telegraph M-395–6
 Hall of Fame, *table* H-249
 telegraph invented by M-396, T-36, 38, *picture* I-201: patented, *table* I-199
 transatlantic telegraph cable F-63, M-396
 wireless signals R-42

Morse code, in telegraphy T-36, *picture* T-36
 signaling S-179

Mortality. *See in Index* Vital statistics

Mor'tar, in masonry L-244

Mortar, short cannon firing at high angles A-397, *picture* A-398. *See also in Index* Trench mortar

Mortara (*môr-tä'rä*), town in n. Italy 25 mi. s.w. of Milan; pop. 8913; makes cheese and hats; Austrians defeated Sardinians 1849.

Mortar and pestle, a two-piece implement of stone, wood, or metal for grinding or pulverizing; mortar is receptacle, pestle the sticklike crusher.

'Morte d'Arthur' (*môrt där-tụr'*), greatest collection of Arthurian romances; first printed by William Caxton in 1485: A-394, E-376

Mortenson, Ingri. *See in Index* Aulaire, Edgar Parin d'

Mortgage (*môr'gāg*), C-510, 508. *See also in Index* Law, *table* of legal terms
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 insurance companies hold I-168*a*, *chart* I-168
 security for bank loans B-47
 security for bonds S-398

Mort Homme (*môr tôm*) (Dead Man's Hill), key to Verdun in World War I V-451

Mortimer's Cross, battle in Wars of Roses 1461, in w. England, 40 mi. s.w. of Birmingham; Edward, duke of York, defeated Lancastrians.

Mortise. *See in Index* Architecture, *table* of terms

Morton, John (1724–77), signer of Declaration of Independence; born Ridley, Pa.
 signature reproduced D-37

Morton, J(ulius) Sterling (1832–1902), American journalist; U. S. secretary of agriculture 1893–97; estate in Nebraska City is a state park. *See also in Index* Statuary Hall (Nebraska), *table*
 originates Arbor Day A-295

Morton, Levi Parsons (1824–1920), banker, born Shoreham, Vt.; minister to France 1881–85; governor of New York 1895–97
 vice-president of U. S. *See in Index* Vice-president, *table*

Morton, Oliver Perry (1823–77), statesman, born Salisbury, Ind.; governor of Indiana 1861–67, and perhaps greatest of all war governors; U. S. senator 1867–77. *See also in Index* Statuary Hall, (Indiana), *table*

Morton, Thomas (1590?–1646), English adventurer, a Royalist rake who amused himself at expense of the "precise Separatists that lived at New Plymouth"; set up a Maypole, and sold rum and guns to the Indians at Merry Mount, now Quincy, Mass.

Morton, William Thomas Green (1819–68), dentist, born Charlton, Mass.; important work in discovery and use of surgical anesthesia: A-246
 Hall of Fame, *table* H-249

Morton Arboretum, near Lisle, Ill.; established 1922 by Mr. Joy Morton, son of J. Sterling Morton; 835 acres: B-262

Mosaic (*mō-zā'ik*) M-396
 building in Gold Coast Colony, *picture* G-134*b*
 Roman sun-god, *picture* A-300
 St. Mark's I-280
 Santa Sophia wall, *picture* A-313
 sidewalk in Brazil, *picture* B-292

Mosaic disease, a highly infectious virus disease affecting many plants including cucumber, potato, tomato, bean, and turnip; causes dwarfed growth and mottled (mosaic) and distorted leaves: P-304
 Stanley isolates virus V-493

Mosaic law, law of the Hebrews, first laid down by Moses M-399

Mosander (*mụ-sän'dẽr*), **Carl Gustav** (1797–1858), Swedish chemist and mineralogist, discoverer of lanthanum, erbium, and terbium.

Mosasaurs, prehistoric reptiles R-114, 115, *picture* P-406*a*

Mosby (*mōz'bĭ*), **John Singleton** (1833–1916), Confederate soldier, guerrilla raider, and commander of independent cavalry body called Mosby's Rangers; particularly active in Virginia and Maryland 1863–64; said to have originated phrase "the solid South."

Moscheles (*mŏsh'ĕ-lĕs*), **Felix** (1833–1917), English portrait painter (Grover Cleveland, Browning, Gounod, Henry M. Stanley, and other famous men); intimate friend of Whistler, Du Maurier, and literary and artistic men of his time; son of Ignaz Moscheles.

Moscheles, Ignaz (1794–1870), Bohemian pianist and composer, born Prague; teacher and friend of Mendelssohn; compositions include piano concertos, sonatas, chamber music.

Moschus (*mŏs'kŭs*) (2d century B.C.), Greek pastoral poet of Syracuse ('Europa').

Moscicki (*mōsh-chĕt'skē*), **Ignacy** (1867–1946), Polish chemist; 3d president of Poland, 1926–39; went to Switzerland 1939.

Moscow (*mŏs'kō*), Idaho, town 65 mi. s.e. of Spokane, Wash.; pop. 10,593; flour, lumber, clay products; livestock; pea industry: *maps* I-20, U-252
 University of Idaho I-23, *picture* I-24

Moscow (*mŏs'kou* or *mŏs'kō*), Russian **Moskva**, capital and largest city of Russia; pop. 4,500,000: M-396–9, R-284, 285, *maps* R-266–7, E-417, A-531, *picture* M-397
 cities, world's largest. *See in Index* City, *table*
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 Lenin's tomb M-398, *picture* M-397
 Moscow Art Theater R-275
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 Red Square, *picture* M-397
 St. Basil the Blessed, Church of M-398, *pictures* M-397, R-272
 street scene, *picture* R-269

Moscow-Volga Canal M-398, *picture* R-281. *See also in Index* Canals, *table*

Moseley, Edward, North Carolina leader N-279

Moseley, Henry Gwyn-Jeffreys (1887–1915), English physicist; gave his name to the Moseley number, and alternative name for atomic number
 X-ray spectra discoveries X-330, S-334

Moselle (*mō-zĕl'*), department of France in region called Lorraine; 2403 sq. mi.; pop. 622,145: A-181

Moselle River (German **Mosel**), in n.e. France and s. Germany; flows 320 mi. n.e. to Rhine at Coblenz; valley noted for vineyards: *maps* F-259, B-111

Moses, Hebrew leader and lawgiver M-399, J-352, *picture* M-399
 statue by Michelangelo M-214, S-78*c*, *pictures* M-212, M-399
 'The Finding of Moses' by Paola Veronese P-27*a*, *color picture* P-27*a*

Moses, Anna Mary Robertson (Grandma Moses) (born 1860), self-taught "primitive" artist, born Washington Co., N. Y.; began painting in her 70's; rustic scenes, in intricate design, suggestive of old samplers.

Moses ben Maimon. *See in Index* Maimonides

Moshav, co-operative colony in Palestine P-46

Moskva, Russia. *See in Index* Moscow

Moslem League, political party in India, founded 1906 I-68*a*, P-42*b*
 Mohammed Ali Jinnah I-68*a*, P-42*b*–3

Moslems, also **Muslims**, or **Muslems**, name applied to themselves by the followers of Mohammed. *See in Index* Mohammedanism

Mosley, Sir Oswald E. (born 1896), English political figure; member of Parliament as Conservative, later as Labor; 1931 headed the "New party" (Fascist), which was defeated in elections; imprisoned 1941, released 1943; later leader in Fascistlike Union Movement.

Mosque (*mŏsk*), a Mohammedan temple of worship
 Banya-Bashi, Sofia, *picture* B-349
 Great Mosque, Delhi, *picture* M-330
 Great Mosque, Mecca M-157: pilgrims in courtyard, *picture* M-157
 Kabul, Afghanistan, *picture* A-32
 Kadhimain, Baghdad, *picture* I-225
 Koutoubia Mosque at Marrakech, *color picture* A-38
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 Omar, or Dome of the Rock J-336, *picture* A-415
 Santa Sophia, *pictures* A-309, A-410
 Shah Jehan, Delhi, *picture* D-61
 Sultan Achmet, Istanbul, *pictures* T-220*a*, A-310, A-410

Mosquito (*mŏs-kē'tō*) M-400-4, *pictures* M-400-4
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"song" M-400
yellow-fever carrier, conquest M-403: Gorgas' work G-142; Panama P-56
Mosquito boat, in naval warfare M-438, N-87, *picture* N-88
Mosquito Coast, or **Mosquitia,** strip of land occupied by Mosquito Indians on e. coast of Central America; British protectorate until 1860; now part of Nicaragua; long source of diplomatic disputes between Great Britain and U. S.: C-177
Mosquito hawk, dragonfly D-123
Mosquito netting, or **mosquito bar,** a coarse, stiff, cotton net, plain or barred; used, especially in South, as canopy for beds and baby carriages; also for window screening.
Moss, a small, flowerless plant, of the phylum *Bryophyta* M-404-6, *pictures* M-405
Moss, club. *See in Index* Club mosses
Moss, Iceland, a lichen L-220
Moss, Irish, or **carrageen,** a seaweed, source of vegetable gelatin S-95, *picture* S-94, *color picture* P-287
Moss, reindeer, a lichen most abundant in arctic and subarctic regions; large starch content: L-220
Moss, Spanish. *See in Index* Spanish moss
Mossadegh (*mŏs'a-dĕk*), **Mohammed** (born 1880?), Iranian lawyer and statesman, born Tehran, Iran; minister of justice 1920; minister of finance 1921; minister of foreign affairs 1922; member of parliament 1923-27, 1944-46; premier 1951-53; fought for nationalization of Iran's oil industries and for reforms to raise status of peasants; came to U.S. 1951 to appear before UN on British-Iranian oil dispute; convicted of treason Dec. 1953 and sentenced to three years of solitary confinement: I-224
Moss agate J-348
Moss animals, the Bryozoa, *Reference-Outline* Z-364
Moss campion. *See in Index* Silene
Moss locust, or **rose locust,** American species of locust tree L-294
Moss pink, a phlox P-204
Moss rose R-230
Moss stonecrop. *See in Index* Stonecrop
Mossy cup oak, or **bur oak** O-319, 320
Mostaganem (*mŏs-tä-gä-nĕm'*), Algeria, city on n. coast 48 mi. e. of Oran; pop. 50,403: *maps* A-167, A-46
Mostar (*mŏs-tär'*), Yugoslavia, city 46 mi. s.w. of Sarajevo; pop. 31,608; former capital of Herzegovina; fine Roman bridge: *map* E-425
Most Favored Nation Clause, a treaty provision between nations I-195, T-17
Mosul (*mō-sōl'*), city in Iraq (Mesopotamia) on Tigris River 220 mi. n.w. of Baghdad; pop. 203,273; caravan trade: *maps* I-224, A-285, A-406
declared part of Iraq I-225
ruins of Nineveh N-239
Moszkowski (*mŏsh-kŏf'skē*), **Moritz** (1854-1925), composer and pianist, born Breslau, Germany, of Polish parents; works include an opera ('Boabdil'), a symphonic poem ('Jeanne d'Arc'), and exquisitely beautiful pieces for piano ('Spanish Dances').
Motacil'lidae, a family of perching birds embracing the wagtails and pipits B-178
Motet. *See in Index* Music, *table* of musical terms and forms
Moth, an insect B-365-9, *pictures* B-367c-8, *color pictures* B-366-7, I-233. *See also in Index* Caterpillar
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cecropia, *color picture* I-233; bumblebee, *color picture* P-420b; caterpillar, *picture* C-138
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corn borer I-163, *picture* I-162
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made of naphthalene C-371
Mother Carey's chickens, popular name for Wilson's petrel or other storm petrels P-167
Mother Goose M-406
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first collection published L-270
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'Jack and Jill', origin M-389
'Sing a song of sixpence', origin K-57, M-406
Mother Gunga, the Ganges River, in India G-10. *See also in Index* Ganges River
Mother Hubbard, Old M-406
Mother Jones. *See in Index* Jones, Mary (Mother)
Mother of Civilization A-402
Mother of Parliaments P-87
Mother-of-pearl, or **nacre** S-139a, P-107
obtained from abalone S-139b
Mother of Presidents, nickname for Virginia V-490
Mother of States, nickname for Virginia V-490
Mother of vinegar V-474
Mother rule in family F-18a
Mother's Day F-58
Mother Shipton, reputed prophetess, supposedly lived in England in 16th century; purported collections of her prophecies appeared later.
Mothers' pensions P-141, F-251
Motherwell, William (1797-1835), Scottish poet, born Glasgow; 'Jeanie Morrison' and 'The Cavalier's Song' among best-known poems; made famous collection of ballads.
Moth miller, miller, or **owlet moth,** moth of the cutworm C-532
Motif, in music. *See in Index* Music, *table* of musical terms and forms
Motion, function of living L-224
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Motions, in parliamentary law P-90-1, *table* P-90
Motive, in music. *See in Index* Music, *table* of musical terms and forms
Motley, Archibald J. (born 1891), Negro painter, born New Orleans, La.; paintings of Negro life.
Motley, John Lothrop (1814-77), historian, born Dorchester (now part of Boston), Mass.; minister to Austria 1861-67 and to England 1869-70; wrote scholarly histories of Netherlands ('The Rise of the Dutch Republic'; 'The History of the United Netherlands'; 'Life and Death of John Barneveld'): A-227
Hall of Fame, *table* H-249

A LIST OF COMMON MOTION-PICTURE TERMS

Acetate. A nonexplosive type of film base, often called safety film to distinguish it from the highly inflammable and explosive nitrate base.
Action. The director's order to start the action within the shot. The order is given when camera and sound equipment are running at proper speed.
Animation. Process of bringing inanimate objects, such as drawings or puppets, to apparent life.
Answer print. The first composite print (both picture track and sound track on one strip of film) turned out by the laboratory. This print is used for checking possible errors before release prints are ordered.
Barn doors. Hinged panels mounted on lights, which can be adjusted to keep light off certain areas where it is not wanted.
Billing. Place and size of the players' names in the list of the cast.
Bit. A small part, either speaking or silent, but sometimes of great importance in the film.
Blimp. The soundproof housing around the camera, necessary to keep the camera noise from being picked up by the microphone.
Bloop. Noise made by a poorly spliced patch on the sound track when it passes through a sound reproducer; also the corrective process by which the noise is made inaudible.
Boom. A mobile camera crane permitting a wide range of angle and movement. A smaller type is used as a microphone boom to project the microphone over the set.
Breakdown. The detailed separation of the script into shots, set-ups, etc., for purposes of budgeting and making a shooting schedule.
Broad. Name given to the larger incandescent lamps from those using 500-watt bulbs to those with two 1,000-watt bulbs.
Business. Any bit of characterization in acting.
Call sheet. The daily shooting schedule indicating who and what will be needed for that particular day and where it will be photographed.
Camera angle. Position of the camera during a shot, the field of view of the camera during the shot.
Can. A metal film container, designed usually to hold one standard reel of film.
Catwalk. Overhead bridges and paths on the rigging suspended over a set.
Cel, or Cell. A transparent piece of celluloid with two or more punched holes to fit registration pins on an animation stand. The final drawing and painting in animation is done on cels.
Cello. Glass with a certain cellular pattern which diffuses the light coming through it.
Cement. A liquid consisting of acetone and celluloid used to splice film.
Cinema. Motion pictures or a motion-picture theater. From the Greek word *kinema*, meaning "motion."
Clappers. Hinged pieces of wood which are clapped together before each take to help the editor synchronize action with sound. Now rarely used in studio shooting.
Code numbers. Numbers printed on the edge of the film by the editor to provide sync marks at one-foot intervals. (*Not* the same as edge numbers which are printed on the negative by the film manufacturer.)
Commentary. The words spoken on the sound track to explain what is seen, to make comments on it, or to serve as counterpoint to it. Also called narration.
Composite print. A positive film with both picture and sound track on the same strip of celluloid.
Cut. The director's order to stop the camera and the action within the shot. A cut is also the instantaneous moving from one shot to another resulting from splicing them together.
Cutter. The man who selects, assembles, and splices the various strips of film into a coherent unity. Also known as the film editor.
Dailies. The first prints delivered every day by the laboratory of scenes shot the previous day and projected for the director and his staff after each day's shooting. Also called rushes.
Diffusers. Various partly transparent devices, made out of different materials, placed in front of lights to soften their intensity. They go by different names such as jellies, scrims, etc.
Dimmer. An assembly of rheostats used to raise or lower the intensity of the lights.
Dissolve. An optical effect in which one scene slowly melts away while the next scene appears. Also called lap dissolve. Used to indicate the passing of time, a shift in scene, or a bridge between parts of the film.
Documentary. A specific type of film using actual events, not fictional stories; everyday people, not actors; and actual backgrounds, not studio-built sets.
Dolly. A light, compact, movable camera platform used to make dollying or tracking shots in which the camera is moved either toward or away from the subject.
Double. An actor who takes the place of a star in a hazardous bit of action.
Double exposure. The photographing of two separate images on one film, so that on the positive film the two images are superimposed.
Dubbing. The process of putting the separate dialogue, sound, and music tracks onto one sound track.
Dupe negative. A duplicate negative made by printing from a positive. Needed when a shot is to be used twice. All optical effects are made from dupe negatives.
Electrician. The man who handles and places the lights on a motion-picture set and sees to it that they are correctly supplied with current, carbons, etc.
Exchange. A distributing office where films are rented to the theaters, inspected, and put in condition after showing. Big film companies have exchanges in all principal cities.
Exterior. All scenes shot out of doors, whether on location or on a studio back lot.
Extra. Actor, hired by the day, who usually has no lines to speak. Extras are used mainly when crowds or groups of people are needed.
Fade. A gradual darkening (fade out) or lightening (fade in) of the whole scene. There are optical and chemical fades.
Fishpole. A long, lightweight pole from which the microphone is suspended; used when the boom is inconvenient.
Flashback. Scenes used to show past events in a story.
Flat. Canvas frame or thin board used in building sets.
Follow focus. The constant adjustment of the focus of a lens by the assistant cameraman, needed whenever the distance between the camera and subject becomes too great during moving shots.
Footage. The measurement of a film or of a number of shots in feet of film.
Frame. The single picture on a strip of film.
Gaffer. The key electrician on a set, under the cameraman's direction, responsible for all the lighting.
Gag. Any comedy situation or action.
Ghost. A patch of light, somewhat like a flare, visible on the film due either to internal reflections within the lens or to strong external lighting striking into one side of the lens.
Gobo. A black, usually wooden, panel mounted on a portable adjustable stand used to control the direction of the light.
Grip. The stagehand who does all the physical labor on a set, such as the moving of flats and furniture, laying of camera tracks, making minor repairs, etc.
High hat. A very low camera mount for use on the floor, in general for any situation where low camera placement is desired.
Inky-dink. Name for the small (150–200 watt) incandescent lamps used for highlighting spots.
Interlock. Method whereby camera motor is made to turn at the same speed as the recording on the projector motor for purposes of synchronization, particularly in process shooting.
Interior. Any scene shot indoors.
Jenny. Name for portable electric generator.
Junior. A lighting unit providing concentrated light with a 1,000- or 2,000-watt bulb.
Leader. Blank film at the start of the print, used for threading film through the projector. Every separate reel of a release print now has a standardized, so-called Academy leader of 12 feet, named after the Academy of Motion Picture Arts and Sciences.
Location. Denotes any place, outside the studio, where films are being made.
Lot. The open area around a film studio where exterior sets have been erected.
Master negative. The final arrangement of the negative from which positive release prints will be printed. Often, however, these are printed from dupe negatives in order to save the master.
Matte shot. The method that allows part of the picture to be masked out during exposure. Used for trick work.
Mixer. The key man on a sound crew, who controls the balance and quality of the sounds as they are being recorded.
Montage. The European word for editing; here generally used to indicate a conglomeration of short, quick, and often unrelated scenes in which the editor attempts to say much in a short time.
Moviola. Trade name of a motor-driven, film-viewing machine used in the editing process. There are other editing machines also.
Optical printer. Mechanism using a lens system to reduce, enlarge, or otherwise modify the negative or part of the negative by projection. The optical printer produces many effects such as fades, dissolves, wipes, reduction prints, trick work, etc.
Panning. Movement of the camera horizontally, usually as it follows a moving object. Originally called panoramic shot. Sometimes the word is used for any camera movement.
Parallel. A platform that can be set up anywhere on the set or on location to raise either the camera or lights from the floor.
Playback. A method of filming whereby musical scores are prerecorded and then played back on the set, allowing singers, dancers, and musicians to perform in time to the music without having to be concerned with extraneous noises.

(Continued on the next page)

A LIST OF COMMON MOTION-PICTURE TERMS—*Concluded*

Preview. Advance showing of a film, usually in order to gauge audience reactions.
Process shot. A technique whereby scenes are staged in front of a translucent screen on which a previous photographed scene (either moving or still) is projected in synchronization with the camera photographing the combination of both.
Prop. Contraction of "property"; any *object which is used in the action of a* story. Props are the responsibility of the property man.
Raw stock. Film which has not been exposed or processed.
Release. The finished picture, available for rental, on or after a certain date—the release date.
Rerecording. The transfer of various sound tracks to one track in the process of which they can be balanced against each other and can be corrected in level and tone.
Rigging. The preliminary placing of lights, catwalks, and parallels on a set.
Rough cut. *The first assembly of the* shots of a film in their proper sequence, but not cut down to their final length. The final assembly is called the fine cut.
Screenplay. The written scene-by-scene story of a motion picture. Also called script.
Script clerk. The assistant to the director responsible for keeping a complete set of notes of all scenes and takes shot, their precise content, costumes, actions, business, etc. These notes are used as an aid by the editor. Since script clerks are usually women, they are also called script girls.
Senior. A lighting unit providing concentrated light with a 5,000-watt bulb.
Set. The room, building, etc., where the action takes place; any place that forms the scene of a motion-picture shot.
Shot. The basic, irreducible element out of which films are made; a shot is what is photographed from the moment the camera starts until it stops.
Slate. A sign held up to the camera *before each scene and photographed to* identify the scene by number, take, name of picture, director, and cameraman. Studios now use automatic slates, which also supply synchronization marks.
Slow motion. The grotesque and interesting effect in which the action is very slow. Secured by running the camera many times normal speed. Projected at normal speed, the action is thus slowed down.
Sound stage. The soundproofed studio building in which the sets are built and the shooting takes place.
Sound track. *The narrow strip, along* side the picture on the film, on which the sound record is fixed photographically.
Splice. The place where two pieces of film have been cemented together to make one continuous piece. This joining is called splicing, and the instrument on which it is done is called the splicer.
Spot. Lamp that can be focused to produce a narrow, powerful beam of light to accentuate part of a scene.
Still. Picture taken during production with an ordinary, not a motion-picture, camera for purposes of advertising and general publicity.
Stock shot. A shot, kept in the film library, of well-known places, historical events, etc., which can be used for many different productions.
Story board. A board on which are arranged, in sequence, rough sketches of the scenes to be photographed, with appropriate captions.
Sync. Abbreviation of the term "synchronism," which refers to the proper matching of sound track to picture. "In sync" means picture action and sound coincide perfectly.
Take. As each scene is photographed, perhaps over and over until action and sound are correct, it is given a number. Each of these attempts at a perfect scene is called a "take."
Trailer. Short film that advertises coming attractions.
Treatment. The intermediary step between rough outline and shooting script. It is a detailed narrative, in proper sequence, of all the elements of the final script without any technical directions.
Underscoring. Recording a musical background as an accompaniment to dialogue.
Wipe. Optical effect whereby one shot is wiped away by a second one. Wipes can run in any direction and they come in innumerable patterns. Wipes are rarely used today.
Workprint. The first positive print made from the negative of sound and action, used by the editor to arrange the film in its final desired form.

Motmot (*mŏt'mŏt*), a tropical American bird (of family *Momotidae*), about the size of a blue jay with brilliant blue and green plumage. The middle feathers of its tail are longer than the others and have a peculiar racket shape, due to the fact that some of the barbs break off, leaving part of the quill bare.
Moton, Robert Russa (1867–1940), Negro educator, born Amelia County, Va.; instructor Hampton Institute (1890–1916); succeeded Booker T. Washington as president Tuskegee Institute 1915, retired 1935 ('Racial Good Will'; 'Finding a Way Out', autobiography; 'What the Negro Thinks').
Motor M-435–6, *pictures* M-435–6. *See also in Index* Diesel engine; Electric motor; Internal combustion engine; Steam engine
  airplane A-99–100: diesel A-100; radial, air-cooled A-99–100; reaction J-341–4
  automobile A-514–17, *diagrams* A-515, 516, 517, 518
  gas and gasoline engines M-435–6, D-89, I-186, *chart* I-186
  motorboat M-436–8
  reaction motor J-341–4
  rocket G-225*b*
  turbine T-210–12, *pictures* T-211–12: gas turbine, *chart* I-186; jet aircraft engines J-342–4
  water W-68, T-212
  wind W-149
Motor area, of brain B-281–2, *pictures* B-282, 283
Motorboat M-436–8, B-216–17, *pictures* M-437
  diesel engine D-89–90
  gas engine M-435–6, D-90, I-186
  outboard motor B-217, *picture* M-435
  remote control by radio R-40
  types classified B-217
Motorbus. *See in Index* Bus
Motor Carrier Act (1935), U. S. B-364*a*, I-198, T-195
Motorcycle B-143, *picture* B-142
Motor fuel P-177–8, A-145, G-33
Motor nerves, or **efferent nerves** B-279, 281–2, N-110, 112, *pictures* N-111, 112
Motor sailers, boats M-438
Motor ship S-156
Motor torpedo boat M-438, N-87, *picture* N-88
Motor transport A-500–3. *See also in Index* Automobile; Bus; Truck; and subjects beginning with word motor
  U.S. percentage of world total, *chart* U-324
Motor truck. *See in Index* Truck
Mott, John Raleigh (1865–1955), foreign mission and Y.M.C.A. leader, born Livingston Manor, N. Y.; Y.M.C.A. leader 1888–1915; chairman, World's Committee of Y.M.C.A.'s since 1926; in 1895 helped organize World's Student Christian Federation, and was general secretary 1895–1920; chairman, International Missionary Council, 1921–42; shared 1946 Nobel peace prize with Emily Greene Balch.
Mott, Lucretia (1793–1880), Quaker abolitionist, women's-rights advocate M-438, *picture* M-438
  women's-rights convention W-184
Motta, José Vianna da. *See in Index* Vianna da Motta, José
Motte (*mŏt*), **Rebecca Brewton** (1739–1815), South Carolina Revolutionary War heroine S-294
Motte-Fouqué, Baron de la. *See in Index* La Motte-Fouqué
Mottl (*mŏt'l*), **Felix** (1856–1911), German musical conductor and composer, born near Vienna; gifted conductor of Wagner's music; general music director, Munich ('Agnes Bernauer' and other operas).
Motto, state. *See* Fact Summary with each state article
Mottram, Ralph Hale (born 1883), English author; writer of war stories and historical novels ('Spanish Farm', trilogy; 'Ten Years Ago'; 'The Boroughmonger').
Mouflon (*mọf'lŏn*), a wild sheep S-136
Mould. *See in Index* Mold
Moulins (*mọ-lăn'*), France, town on Allier River about 90 mi. n.w. of Lyons; pop. 20,832; famous cathedral: *maps* F-270, E-425
Moulmein (*mōl-măn'*), city in lower Burma on Gulf of Martaban; pop. 71,181; trade in teak and rice: B-361, *maps* I-123, A-407
Moulton, (Ellen) Louise Chandler (1835–1908), storywriter and poet, born Pomfret, Conn. ('Bedtime Stories' and other books for children; 'In the Garden of Dreams' and other poems).
Moulton, Forest Ray (1872–1952), astronomer, born Le Roy, Mich.; University of Chicago 1898–1927; research associate Carnegie Institution 1908–23 ('Astronomy'; 'Consider the Heavens')
  planetesimal theory P-285, E-177
Moultrie (*mōl'tri*), **William** (1730–1805), general in Revolutionary War, born Charleston, S. C.; built fort on Sullivan's Island to protect Charleston (later named Fort Moultrie), where he repelled a fierce British attack in 1776; held prisoner by British 1780–82; later governor of South Carolina
  flag devised by F-130*c*, *color picture* F-128
  repulses British attack S-294
Moultrie, Ga., city in s.w. of state, 37 mi. n. of Florida border; pop. 11,639; packed meats, watermelons;

named for Gen. William Moultrie: *map* G-77
Mound birds. *See in Index* Megapodes
Mound Builders, prehistoric American Indians M-438–9, I-27, I-109, *picture* I-41
Cahokia Mound, *picture* M-438
Mound-building ant, or mason ant A-253, 255, 257
Mound-building termite T-74, 76, *picture* T-76
Mound City Group National Monument, in Ohio N-37, *map* N-18
Mounds, in archaeology A-299
Moundsville, W. Va., commercial city 11 mi. s. of Wheeling, with farming and coal interests; pop. 14,772; glass, enameled ware, toys; zinc smelter; state penitentiary; named from relics of mound builders discovered there: *map, inset* W-107
Mounet-Sully (*mo̤-nĕ' sü-lē'*), **Jean** (1841–1916), French actor; passionate vigor of his acting strikingly suited to variety of tragic and romantic parts (*Oedipus, Hamlet,* Hernani, Ruy Blas).
Mount, William Sidney (1807–68), artist, born Long Island, N. Y.: portraits and American genre; after death sank into obscurity in period dominated by European influence; later recognized as pioneer painter of everyday American life.
Mount. *See in Index* under specific names, as McKinley, Mount
Mountain M-439–40, *Reference-Outline* G-47. *See also in Index* names of chief mountains and mountain systems. For a list of the highest mountains *see table* on this page
avalanche A-529
civilization spread affected by M-440: Greece G-197; Spain S-311; United States U-251
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domed E-187
geology E-181: Appalachians A-276–7, *diagram* A-276; fossils show marine life F-244
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highest peak on earth, Everest E-450, *diagram* A-455, *map* I-54, *picture* A-409
highest range in world, Himalaya H-355
lunar M-382
oil from P-181
origin M-439–40, G-50, 54, 59, E-181, 186, *diagram* G-55
submarine M-439: Atlantic A-451
tunnels T-209, *picture* T-208
volcanoes V-518–20, *color pictures* V-521–2, *diagrams* V-518–19
Mountain, French party during Revolution F-294
Mountain ash M-439, *pictures* M-439
Mountain beaver, a rodent of the family *Aplodontiidae,* native only to the Pacific coast of North America; about 14 in. long, with a blunt head, small eyes and ears, and very short tail; lives in burrows in moist woods; not a true beaver; also called boomer or whistler.
Mountain bluebird, or Arctic bluebird B-212
state bird, *table* B-158
Mountain cranberry. *See in Index* Lingenberry
Mountaineers, or mountain whites, inhabitants of a mountain region; specifically, in U.S., natives of mountain regions of s. U.S.: U-270
Great Smoky Mountains G-187
Kentucky K-24
Virginia V-490
Mountain goats, or goat antelopes, animals intermediate between goats and antelopes; term often applied to *any wild* goat, such as *ibex,* living in mountains
Rocky Mountain goat A-262, *color picture* N-259
Mountain hare R-18
Mountain laurel L-137, *picture* L-137, *color picture* F-177
state flower of Connecticut and Pennsylvania, *color picture* S-384*a*
Mountain lion. *See in Index* Cougar
Mountain Men C-128*a*
Mountain sheep. *See in Index* Bighorn
Mountains of the Moon. *See in Index* Moon, Mountains of the
Mountain spurge. *See in Index* Pachysandra

HIGHEST MOUNTAINS IN VARIOUS COUNTRIES

	Height in Feet
Aconcagua, Argentina (*highest in South America*)	22,835
Blanc, France (*highest in Alps*)	15,781
Elbrus, Russia (*highest in Europe*)	18,481
Etna, Sicily	10,750
Everest, Nepal (*highest in world*)	29,028
Fujiyama, Japan	12,461
Godwin-Austen, Kashmir (*2d highest in world*)	28,250
Kilimanjaro, Africa (*highest in Africa*)	19,319
Kosciusko, Australia (*highest in Australia*)	7,328
Logan, Canada (*highest in Canada*)	19,850
McKinley, Alaska (*highest in North America*)	20,269
Markham (*highest in Antarctica*)	15,102
Mauna Kea, Hawaiian Islands	13,784
Mitchell, N. C. (*highest in eastern U. S.*)	6,684
Orizaba, Mexico (*highest in Mexico*)	18,700
Washington, N. H. (*highest in northeastern U. S.*)	6,288
Whitney, Calif. (*highest in continental U. S.*)	14,495

Mountain States, name used by U. S. government for geographic division including states of Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada.
Mountain time T-136, *map* U-252
Mountain whites. *See in Index* Mountaineers
Mount Allison University, at Sackville, New Brunswick, Canada; United Church of Canada; chartered 1858; arts and sciences, applied science, engineering, fine and applied arts, home economics, music.
Mount Angel Seminary, at St. Benedict, Ore.; Roman Catholic; for men; founded 1887; arts and sciences, religion.
Mountbatten (*mount-băt'ĕn*) **of Burma, Louis Mountbatten, 1st Earl** (born 1900), British naval officer and statesman, born Windsor, England, cousin of King George VI of England; chief of commandos 1942–43; supreme allied commander s.e. Asia 1943–46; viceroy of India March–Aug. 1947, then governor general Dominion of India until June 1948; fourth sea lord in Royal Navy 1950–52; commander in chief of all Allied forces in Mediterranean except the U. S. Sixth Fleet 1952–54; became first sea lord 1955.
Mount Carmel, Pa., borough in an-*thracite region,* 45 mi. n.e. of Harrisburg; pop. 14,222; textiles, cigars, iron goods: *map* P-133
Mount Carmel man M-70
Mount Clemens, Mich., city, summer resort on Clinton River 21 mi. n.e. of Detroit in farming section; pop. 17,027; pottery; Selfridge Field, U. S. airfield, 3 mi. east; medicinal springs: *map* M-227
Mount Desert Island, off coast of Maine; 100 sq. mi.: M-55, *maps* M-46, 53
Acadia National Park N-30, *map* N-18
Mountevans, Baron. *See in Index* Evans, Edward
Mount Holyoke College, at South Hadley, Mass.; for women; chartered 1836 (opened 1837) as seminary, college since 1888; arts and sciences, art, education, music, religion; graduate studies: *picture* M-136
Mount Hope Bay Bridge, in Rhode Island. *See in Index* Bridge, *table*
Mount McKinley National Park, Alaska N-37, M-16, *color picture* N-28, *maps* A-135, N-18
Mount Mary College, at Milwaukee, Wis.; Roman Catholic; for women; founded 1915; arts and sciences.
Mount Mercy College, at Pittsburgh, Pa.; Roman Catholic; for women; founded 1929; arts and sciences, education, home economics, nursing.
Mount Palomar Observatory, n.e. of San Diego, Calif. G-122*a*, O-324, T-48, *pictures* O-324, 325, T-46
Mount Pleasant, Mich., city 43 mi. w. of Bay City, on Chippewa River; pop. 11,393; oil center; farming; airport; state hospital; Central Michigan College of Education; Indian Reservation nearby: *map* M-227
Mount Rainier (*rā'nēr*), **Md.,** town adjoining Washington, D.C., on n.e.; residential suburb; pop. 10,989: *map, inset* M-116
Mount Rainier (*rā-nēr'*) **National Park,** Washington, in Cascade Mts., 60 mi s.e. of Seattle N-37, W-37, *map* N-18, *picture* I-4, *color picture* N-27. *See also in Index* Rainier, Mount
Mount Revelstoke National Scenic and Recreational Park, in British Columbia, Canada N-38*f*, *map* N-38*f*
Mount Rushmore National Memorial, South Dakota S-295, *map* S-302, *pictures* S-306, S-73
Mount St. Agnes College, at Mount Washington, Baltimore, Md.; Roman Catholic; for women; chartered 1890; arts and sciences, education, nursing, medical technology, business.
Mount St. Joseph-on-the-Ohio, College of, at Mount St. Joseph, Ohio; Roman Catholic; for women; founded 1852; arts and sciences.
Mount Saint Mary College, at Hooksett, N. H.; Roman Catholic; for women; chartered 1934; opened 1934; arts and sciences, commerce, education, nursing.
Mount Saint Mary's College, at Emmitsburg, Md.; Roman Catholic; for men; founded 1808; arts and sciences, business administration, education, social science.
Mount St. Mary's College, at Los Angeles, Calif.; Roman Catholic; for women; founded 1925; arts and sciences, nursing.
Mount St. Scholastica College, at Atchison, Kan.; Roman Catholic; for women; founded 1863; arts and sciences, education.
Mount St. Vincent, College of, at New York City; Roman Catholic; for women; founded 1910; arts and sciences.

Mountstephen, George Stephen, Baron (1829–1921), Canadian financier, with Lord Strathcona responsible for completion of the Canadian Pacific Railroad.
Mount Union College, at Alliance, Ohio; Methodist; founded 1846; arts and sciences, music.
Mount Vernon, Ill., city 72 mi. s.e. of St. Louis in agricultural section; pop. 15,600; steel cars, shoes, knit goods, furnaces, canned goods: *map* I-37
Mount Vernon, N. Y., residential and manufacturing city n. of the Bronx, New York City; pop. 71,899; petroleum distribution; electrical devices, garments; St. Paul's Church, national historic site: *map, inset* N-205
Mount Vernon, Ohio, city 46 mi. n.e. of Columbus; pop. 12,185; glassware, bridge parts, engines; birthplace of Daniel Decatur Emmett, composer of 'Dixie': *map* O-356
Mount Vernon, Va., George Washington's home M-440–1, W-21, 16, *map* V-487, *pictures* M-440
  official portrait of Washington, *picture* W-19
  origin of name W-17, *picture* M-440
  record of survey, *map* W-17
  Washington buried W-25
Mount Vernon Memorial Highway N-38*d*
Mount Wilson Observatory, north of Pasadena, Calif. O-324, *picture* C-32
  galactic systems photographed, *picture* S-370
  Mt. Wilson (5710 ft.), *map* C-26
Mourning bride. *See in Index* Scabiosa
Mourning cloak butterfly (*Euvanessa antiopa*) *picture* H-353
  caterpillar and pupa, *color picture* B-367
Mourning dove, wild N. American dove of the genus *Zenaidura;* named for its plaintive cry; sometimes called turtle dove: *color picture* B-181
  food habits B-158
Mouse, a rodent M-441, *picture* M-441
  foot, *picture* F-225
  length of life, *pictograph* A-249
  meadow M-441: balance of nature N-63; bird enemies B-158
  pest M-441, *diagram* N-63
  story 'Lion and the Mouse' F-1
  white-footed. *See in Index* White-footed mouse
  white mice, care of P-185
Mouse deer, or **chevrotain** D-45
Mousefish. *See in Index* Sargassum fish
Mouse River, in North Dakota, and Canada. *See in Index* Souris River
Mouse Tower. *See in Index* Bingen, Germany
Mousseline de soie (*mo̤s-lēn' dŭ swä*) (silk muslin), a delicate silk fabric, somewhat heavier than chiffon, often figured.
Moussorgsky (*mo̤'sôrg-skē*), or **Musorgski, Modest Petrovitch** (1835–81), Russian composer; one of great Russian composers of songs and music drama; closely associated with Rimsky-Korsakov and Balakirev; best known for opera 'Boris Gudenov', marked by barbaric splendor and violence; also opera 'Kovanstchina', orchestral works, songs, and piano compositions.
Mouth, entrance to alimentary canal
  bird B-156
  fish F-102, 107
  insect I-155, *picture* I-154
  man: digestion in P-244, D-90, 91*a*, *diagram* D-91; teeth T-34–6, *pictures* T-34–6; tongue T-147, *picture* T-147
  mollusk M-333
Mouth organ, or **harmonica,** musical instrument H-269–70, *picture* M-471
Mouton (*mo̤'tŏn*), a fur, processed sheepskin, used chiefly for women's coats and hats.
Movable dam D-11
Movement, in dance D-14
Movement, in physiology B-146
  brain cortex and control of movement B-281–2, *pictures* B-282, 283
  function of living L-224
  motor nerves N-110, 112, B-279, *picture* N-111
Movement, in symphonies M-462–3
Moving pictures. *See in Index* Motion pictures
Moving stairway E-329, *picture* E-329
Mo'wat, Sir Oliver (1820–1903), Canadian statesman, leader in movement for Confederation; premier of Ontario 1872–96; lieutenant governor of Ontario after 1897; a Liberal leader who was a strong supporter of provincial rights as against the Dominion Parliament.
Mowgli (*mou'glĭ*), in Kipling's 'Jungle Book' an Indian boy who is adopted by wolves: K-48, *picture* K-49
Moyen Congo. *See in Index* Middle Congo
Moylan, Stephen (1737–1811), Revolutionary War soldier, born Cork, Ireland; served with distinction at battle of Princeton, and with Pulaski and Lafayette's armies; became brigadier general 1783.
Mozambique (*mō-zăm-bēk'*), or **Portuguese East Africa,** an overseas province of Portugal on s.e. coast of Africa; 297,731 sq. mi.; pop. 5,732,317; cap. Lourenço Marques: M-442, *maps* E-199, A-47, S-242, *pictures* M-442
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Mozambique, Portuguese **Moçambique** (*mō-săm-bē'kĕ*), seaport in overseas province of Mozambique; pop. 12,510: *maps* A-47, E-199
Mozambique Channel, strait in Indian Ocean between Madagascar and e. coast of Africa: *map* A-47
Mozart (*mōt'särt*), **Wolfgang Amadeus** (1756–91), Austrian composer M-443, *picture* M-443
  Haydn and H-295
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  operas O-396–7, 388, M-443: 'Marriage of Figaro', story O-391
MP (Military Police). *See in Index* Military Police Corps
MRP, French political party F-273
'Mrs. Wiggs of the Cabbage Patch', novel by Alice Hegan Rice featuring the philosophical Mrs. Wiggs, who shows that life has its good points even in the very poor district of a small Kentucky town.
MTB, boats M-438
Muang Thai, or **Thailand,** name for Siam S-169
Mucha (*mo̤'Kä*), **Alfons** (1860–1939), painter, born in Moravia; lived in Paris; large historical scenes and smaller decorative paintings ('The Epic of Slavic History', series of 20 large paintings in Prague).
'Much Ado About Nothing', one of Shakespeare's comedies, involving Hero and Claudio, lovers, deceived by Don John, and Beatrice and Benedick, battling wits, who also fall in love; Dogberry and Verges, stupid policemen, add humor
  chronology and rank S-129
Mu'cilage, adhesive of gum dissolved in water, *diagram* C-483
Muck (*mu̧k*), **Karl** (1859–1940), German musical conductor; established as chief conductor, Berlin opera, 1892; conducted Bayreuth Festivals for many years; conductor Boston Symphony 1906–8, 1912–18, Hamburg Philharmonic 1922–33.
Muck, soil S-231
Mucous membrane, a membrane that secretes mucus and lines the mouth, throat, windpipe, lungs, eyelids, and the alimentary canal: P-244
Mud, how formed E-184
Mudd, Samuel A. (1833–83), physician, born Charles County, Md.
  imprisonment at Fort Jefferson N-33
Mud dauber, a wasp W-53
  food for larvae I-158
Mudfish, or **lungfish** M-443–5, *pictures* M-444–5, F-108
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Mud Mountain Dam (Stevens), in Washington, on White River. *See in Index* Dam, *table*
Mud puppy, a newt S-26, *pictures* S-25, A-250*b*
Mudskipper, or **skipping goby,** fish M-444, 445, F-102, *picture* F-102
Mudstone, a soft structureless clay rock S-194
Mud turtle, a fresh-water turtle (genus *Kinosternon*) T-224
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Mueller. *See in Index* Müller
Muenster cheese C-207
Muezzin (*mū-ĕz'ĭn*), crier who calls Mohammedans to prayer, *picture* I-255
Mufti (*mŭf'tĭ*), Mohammedan official who interprets the law of the Koran and of tradition; also, term for civilian dress. *See also in Index* Grand mufti
Mugod'zhar Mountains, in Asiatic Russia, range of Ural Mts. extending from Ural River s. almost to Lake Aral; highest point 2145 ft.
Mugho pine, evergreen shrub (*Pinus mugho mughus*) of pine family, native to cent. Europe; a variety of the Swiss mountain pine. Common ornamental shrub in North America. Leaves in twos, to 2 in. long, dark green; cones oval, small. Low-growing with irregular flat crown.
Mugwort. *See in Index* Wormwood
Mugwumps, in U. S. politics, members of one party, who vote with another party (from Indian word meaning "big chief")
  election of 1884 B-205
Muhammed. *See in Index* Mohammed
Mühlberg (*mül'bĕrK*), Germany, town on Elbe River 35 mi. n.w. of Dresden; Emperor Charles V defeated Protestants under Elector of Saxony (1547).
Muhlenberg (*mu̧'lĕn-bĕrg*), **Frederick Augustus Conrad** (1750–1801), Lutheran clergyman, born Trappe, Pa.; member of Continental Congress and House of Representatives (speaker first and third Congresses).
Muhlenberg, Henry Melchior (1711–87), American clergyman, born Germany; emigrated to Philadelphia 1742 and organized first Lutheran synod in America 1748; real founder of American Lutheran church; father of John P. G. and Frederick A. C.

Muhlenberg, John Peter Gabriel (1746–1807), "fighting parson" of the American Revolution, born Trappe, Pa.; fought at Brandywine, Germantown, Yorktown, and was brevetted major general. *See in Index* Statuary Hall (Pennsylvania), *table*

Muhlenberg College, at Allentown, Pa.; Lutheran; for men; founded 1848; arts and sciences.

Muir (*mūr*), **Alexander** (1830–1906), Canadian song writer, born Scotland; public school teacher; in 1867 wrote Canadian national anthem, 'The Maple Leaf Forever'.

Muir, John (1838–1914), American naturalist and explorer M-445
 Muir Woods named for N-37
 quoted, flowers of Mount Rainier N-37

Muir Glacier, large and picturesque ice sheet of s.e. Alaska, in Glacier Bay National Monument; about 350 sq. mi.; discovered by John Muir: A-131

Muir Woods National Monument, in California N-37, *map* N-18

Muizenberg (*mū'zĕn-bûrg*), Union of South Africa, resort suburb s. of Capetown, *picture* S-241

Mukal'la, seaport in Hadhramaut, Aden Protectorate: pop. about 20,000: *maps* A-285, A-407

Mukden (*mụk'dĕn'*), Chinese **Shenyang** (*shŭn'yäng'*), formerly **Fengtien** (*fŭng'tyĕn'*), city in s. Manchuria, on Hun River; pop. 1,120,918; capital of Manchu emperors in 17th century: M-75, *maps* M-72, A-406
 battle (1905) R-296
 mineral deposits near M-74

Mukerji (*mụ'kĕr-gē'*), **Dhan Gopal** (1890–1936), Hindu (Brahmin) author, born Calcutta, India; profound interpreter of oriental civilization (for young people: 'Gay Neck', awarded Newbery medal 1928; 'Chief of the Herd'; for adults: 'Caste and Outcast'; 'Son of Mother India Answers').

Mukluk (*mŭk'lŭk*), knee-high fur boots worn by Eskimos; made of reindeer skins and decorated at top with designs in colored wool or grass.

Mulatas, Archipiélago de las, Panama. *See in Index* San Blas Islands

Mulat'to, a person having one white, one Negro parent.

Mulberry, any of several trees with black, white, or red fruit M-445–6, *pictures* N-49, S-182
 China C-270
 tapa cloth M-446

Mulberry family, or **Moraceae** (*mō-rā'sē-ē*), a family of plants, shrubs, and trees including the osage orange, the mulberries, banyan, fig, bo tree, upas tree, breadfruit, jackfruit, breadnut, hemp, Mexican rubber tree, snakewood tree, fustic, and the hop.

Mulch, material such as manure, leaves, pulverized earth, placed on surface of soil to retain moisture and to protect plant roots from frost
 principle of capillarity C-119
 winter protection for plants G-18

Mul'de River, Germany, rises in Erzgebirge and flows n. 150 mi. to Elbe at Dessau.

Mule, a hybrid animal H-428*h–i*, *picture* H-428*h*
 Central America, *picture* C-177
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 Spain, *picture* S-314

Mule, a kind of spinning machine C-516, I-131, *picture* W-195

Mule deer D-44, *picture* D-43

Mule killer, a mantis M-81, *pictures* M-81, N-53

Mulhacen (*mọl-ā-thän'*), highest summit in Spain, 11,420 ft.; in Sierra Nevada, s.e. of Granada: *map* S-312

Mülheim (*mül'hīm*) **on the Ruhr,** Germany, industrial city just w. of Essen; coal-mining center; pop. 149,589: *map, inset* G-88

Mulholland, John (born 1898), magician, writer; born Chicago, Ill.; taught industrial arts, Horace Mann School for Boys, New York City; editor *The Sphinx*, for magicians ('Story of Magic'): *pictures* M-37–8, 40

Mulhouse (*mü-lọz'*) (German **Mülhausen**, *mül'hou-zĕn*), commercial center in Upper Alsace, France; pop. 85,956; textiles; under German rule 1871–1918; again occupied by Germany 1940–44; *maps* F-259, E-425

Mull, island off w. coast of Scotland, 2d largest of Inner Hebrides; 367 sq. mi.; chief town Tobermory: H-327, *map* B-324

Mull, a thin fabric of cotton or cotton and silk, soft or stiff in finish.

Mul'lah, complimentary title given to Mohammedan priest.

Mullein (*mŭl'ĕn*), tall, woolly biennial herb (*Verbascum thapsus*) of the figwort family, with stout stem, large oblong leaves, and yellow flowers densely arranged on a long cylindrical spike: *color picture* F-180

Mullein pink, dusty miller, or **rose campion,** biennial (*Lychnis coronaria*) of pink family with oblong, hairy leaves; loose clusters of rose-colored flowers: *picture* F-181
 how to plant, *table* G-17

Müller, Franz Joseph (1740–1825), Austrian chemist, discoverer of tellurium (1782).

Müller (*mü'lĕr*), **(Friedrich) Max** (1823–1900), Anglo-German Orientalist, Sanskrit scholar, and popularizer of comparative philology, born Germany; moved to England 1846; taught at Oxford University about 20 years ('Chips from a German Workshop'; 'History of Ancient Sanskrit Literature'; edited 'The Sacred Books of the East').

Müller, George Elias (1850–1934), German psychologist, known for work on memory and color perception; claimed a piece is memorized more quickly by reading whole than by learning bits.

Muller, Hermann J. (born 1890), geneticist and educator, born New York City; taught at University of Texas, Rice Institute, Amherst College; became professor of zoology Indiana University 1945; won 1946 Nobel prize in medicine and physiology for work in heredity, for discoveries of changes in cells produced by X rays and other rays.

Müller, Johannes (1801–58), German physiologist, early student of comparative anatomy and nerves of animals; showed dependency of physiology on other sciences.

Muller, Maud. *See in Index* 'Maud Muller'

Müller, Paul (born 1899), chemist, born Olten, Switzerland; in laboratories in Basel, discovered insect-killing powers of DDT; it proved so effective against disease-carrying insects that he was awarded Nobel prize in medicine 1948: I-164

Mullet, any of about 100 species, most of them tropical, of food fishes occurring in most seas; family *Mugilidae*. The most abundant U.S. species is the striped, or jumping, mullet; stout-bodied; average weight 2 or 3 lbs.; silvery gray; scientific name *Mugil cephalus*. Mullets are the most important food fishes of the South Atlantic and Gulf states. The name mullet is given also to the goatfish, or surmullets: F-114. *See also in Index* Goatfish

Mullica River, in s.e. New Jersey, *maps* N-156, 165

Mullins, or **Mullines, Priscilla,** one of Mayflower Pilgrims M-146
 Miles Standish and S-368

Mullion. *See in Index* Architecture, *table* of terms

Mull of Gal'loway, promontory with lighthouse, s. end Scotland, *map* B-325

Mulock, Dinah Maria. *See in Index* Craik, Dinah Maria

Mulock, Sir William (1844–1944), Canadian statesman; postmaster general 1896–1905; first minister of labor 1900–1905; chief justice of Ontario; chancellor University of Toronto; promoted penny postage within British Empire.

Mulready, William (1786–1863), Irish artist and illustrator; genre paintings resemble those of Dutch school designed postage sheets S-366

Multan (*mụl-tän'*), or **Mooltan,** city in Punjab province, w. Pakistan, 190 mi. s.w. of Lahore; pop. 190,122; silk and cotton, carpets, shoes, pottery; captured by British in 1849: *map* A-406

Multicolor rotary press, in printing, *picture* P-414*b*

Multiflora rose, an Asiatic shrub H-329

Multigraph, duplicating machine for making facsimile copies of words, numerals, lines, pictures from individually prepared master. *Relief process*, from master with raised surface, such as type, metal, or rubber plates; *multilith*, or *offset process*, from a plane surface using paper or metal masters: P-414*c*

Multilateral treaties T-177–8

Multiple arch dam D-10, *diagram* D-8, *picture* D-8

Multiple-dome dam D-10

Multiple-unit control system, in street railway cars S-431

Mul'tiplex telegraphy T-39
 cables use C-6

Multiplicand', *table* M-446

Multiplica'tion, in mathematics M-446–8, A-342, *pictures* M-446, 448, *tables* M-446–7
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 slide rule S-199

Multiplier, *table* M-446

Multno'mah Falls, beautiful cascade in the Columbia River, 30 mi. e. of Portland, Ore.

Mulvaney (*mŭl-vā'ni*), **Terence,** in 'Soldiers Three' and other tales by Kipling, a reckless resourceful Irish private in India.

Mulvian Bridge, over Tiber River. *See in Index* Milvian

Mumford, L(awrence) Quincy (born 1903), librarian, born Ayden, N. C.; held executive positions at New York Public Library 1929–45 and Cleveland Public Library 1945–54; Librarian of Congress 1954–, first professionally trained and experienced librarian in that post; A.L.A. president 1954–55.

Mumford, Lewis (born 1895), author, born Flushing, L.I., N.Y.; lectured on literature and architecture New School for Social Research, New

York City, 1925 and at Dartmouth College 1931–35 ('Sticks and Stones'; 'Technics and Civilization', 'Culture of Cities', 'Faith for Living').
Mummers, or maskers C-296
play, *picture* C-298
Mum'michog, a mudfish M-444, 445
Mummy M-449, *pictures* M-449
case, *pictures* E-446, 449
origin of word A-424
religious belief concerning E-278*a*
Mumps, contagious disease characterized by inflammation and swelling of the parotid glands P-244
mode of infection D-102
Mumuku (*mu-mụ'ku*), violent tradewinds off Hawaiian Islands
Munch (*munsh*), **Charles** (born 1891), French orchestral conductor, born Strasbourg, Alsace-Lorraine, debut as conductor 1932, exponent of modern music, conductor Boston Symphony Orchestra from 1949
Munch (*munk*), **Edward** (1863–1944), Norwegian painter, early works marked by gloomy subjects, these later gave way to realistic and vigorous landscapes and portraits
Munchausen (*mŭn-chô'zen*), **Baron**, the name given the pretended author of a book of tales and travels by **Rudolph Erich Raspe** (*ras'pĕ*) (1737–94) a German scholar who had left his native Hanover for England The real **Baron Hieronymus Karl Friedrich von Munchhausen** (*munk'hou- en*) (1720–97) of Hanover had nothing to do with the book In later editions other writers added 'lies from all literature" to Raspe's original tales
Munchen, Germany. *See in Index* Munich
Munchen-Gladbach (*mun'ken-glät' bäk*), Germany manufacturing center 15 mi s w of Dusseldorf pop 124,879, known for textiles, leather, machinery, foundry products *map, inset* G-88
Mun'cie, Ind, city 51 mi n e of Indianapolis on White River, in agricultural and natural gas region, pop 58,479, automobile parts glass jars, silver-plated flatware, Ball State Teachers College I-84, *maps* I-78, U-253
Munda (*mon'da*), ancient town in s Spain where Caesar defeated sons of Pompey (45 B C)
Munda dialects, of India I-57
Mun'delein, George William, Cardinal (1872–1939), Roman Catholic prelate, born New York City, archbishop of Chicago 1916–39, created cardinal 1924
Mundelein College, at Chicago Ill; Roman Catholic for women, founded 1930, arts and sciences
Mung bean (*Phaseolus aureus*), oriental bean first grown in U S about century ago for livestock feed, now grown as source of sprouts for salads chop suey, and other cooked vegetable dishes B-84
Mungoose. *See in Index* Mongoose
Munhall, Pa, borough on Monongahela River 7 mi s e of Pittsburgh, pop 16,437, iron and steel products· *map, inset* P-132
Muni (*mu'ni*), **Paul** (Muni Weisenfreund) (born 1895) American actor of stage and screen, born Lemberg, Austria (now Lvov, Russia), came to U S 1902, became citizen 1923, famous as character actor in motion pictures ('Scarface', 'The Story of Louis Pasteur', for which he won 1936 Academy award, 'The Good Earth', 'The Life of Emile Zola', 'Juarez').
Munich (*mū'nĭk*), Germany, also **Munchen** (*mun'ken*), city on Isar River, pop 831,937 M-449–50, *maps* G-88, E-416, 425, *picture* M-450
museums and art galleries M-450. *See also in Index* Museums, *table*
Alte Pinakothek Durer's 'Four Apostles' P-27*a–b*, *color picture* P-27*b*
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Municipal ownership, of public utilities P-430, C-323*b*
Fort William, Ontario F-243
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New Orleans belt railway N-183
Regina, Saskatchewan R-96
Tacoma, Wash T-2
waterworks W-73
Muninn (*mo'nin*), in Norse mythology, *picture* O-341
Munkacsy (*mon'ka-che*), **Michael** (1844–1900) Hungarian genre, religious and historical painter, master of a dramatic style and of profound characterization ('Milton Dictating Paradise Lost', 'Christ before Pilate', called by some critics the greatest religious painting of 19th century)
Munn vs Illinois, decision in U-349
Muñoz, Aegidius. *See in Index* Clement VIII
Munro, Hector Hugh (1870–1916) (pseudonym Saki) English shortstory writer and newspaper correspondent born Burma his cleverly written stories are replete with subtle irony, satire, wit geniality, and understanding of human nature, killed in France during World War I ('The Unbearable Bassington', 'When William Came, 'The Short Stories of Saki')
Munroe, Kirk (1850–1930), author of books of adventure for boys, born Prairie du Chien, Wis, while exploring for railroad routes in West became acquainted with Indian life, and knew Kit Carson and Buffalo Bill, later lived in Florida ('The Flamingo Feather', 'Through Swamp and Glade', 'The White Conquerors')
Mun'see, tribe of North American Indians of the Delaware family, sometimes called Wolf because wolf was their totem, a remnant now scattered in United States and Canada
Munsell color system C-394
Munsey, Frank Andrew (1854–1925), publisher, born Mercer, Me, founded *Munsey's Magazine* and other popular periodicals, owned, among other newspapers, *New York Sun* and *New York Herald*, amassed a fortune, of which $17,000 000 was left to Metropolitan Museum, New York City
Munster (*mun'stĕr*), Germany, city in w, 80 mi n e of Cologne, Dortmund-Ems Canal, pop 118-496, textile and leather manufactures university, Peace of Westphalia signed here 1648 *maps* G-88, E-424
Munster, Ireland largest of 4 provinces, in s w 9317 sq mi, pop 898 870 *map* I-227
Munster, Treaty of T-119, N-121
Munsterberg, Hugo (1863–1916), German-American psychologist born Danzig, professor of psychology and director of laboratories at Harvard after 1892 ('American Traits', 'On the Witness Stand', 'Psychology and Life')
Munthe, Axel Martin Frederik (1857–1949), Swedish doctor and author, lived in Paris and on Island of Capri Italy, wrote in English in British Red Cross during World War I ('Story of San Michele')
Munt'jac, barking deer of India D-45
Muntz metal, known also as yellow metal, resists corrosion, invented in 1832 by G F Muntz B-285
Muonio River, Lapland part of boundary between Finland and Sweden, flows into Tornio *maps* N-301, E-417
Murad (*mū'răd*), or **Amurath, I** (1319–89), sultan of Ottoman Empire 1359–89, son of Orkhan, continued expansion of Ottoman rule in Europe, took Adrianople 1361, subjugated Asia Minor, killed in battle against the Serbians
Murad, or Amurath, II (1403–51), sultan of Ottoman Empire 1421–51, son of Mohammed I, fought against the Hungarians under their leader Hunyady, defeated them at Varna 1444 and Kosovo 1448 T-220
Murad, or Amurath, III (1546–95), sultan of Ottoman Empire 1574–95, son of Selim II, rule marked by gains of territory in Persia and losses in Hungary
Murad, or Amurath, IV (1611–40), sultan of Ottoman Empire 1623–40, recaptured Baghdad from the Persians 1638, known for his tyranny and cruelty
Muradabad, India *See in Index* Moradabad
Mural painting, or wall painting
Abbey 'Quest of Holy Grail', *pictures* A-393–4
Alexander 'Labor', *picture* U-386
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Curry, John Steuart 'Tragic Prelude', *picture* B-330
Egypt, ancient E-284, P-24, *pictures* F-319*c*, P-24, D-14*c*
Giotto G-110, 111· 'Adoration of the Kings', *picture* C-293
Hewlett 'Brooklyn Bridge', *picture* A-390
Knight, Charles R, *pictures* M-64, 65
Leonardo da Vinci V-474: 'The Last Supper', *picture* V-473
Mexico M-204, *pictures* M-208, L-116
Michelangelo M-212, 214, S-175: 'Creation of Adam' *picture* M-213, 'Jeremiah' P-27, *color picture* P-27

Raphael R-74
Roman G-207, *picture* G-205
Sargent S-46: 'Frieze of the Prophets', *picture* P-419
Murasaki Shikibu (*mo̦'rä-sä-kē shē'-kē-bo̦*), 11th-century Japanese author; her 'The Tales of Genji' has been translated into English: J-312
Murat (*mü-rä'*), **Joachim** (1767–1815), French Revolutionary cavalry leader, and marshal of the empire; husband of Napoleon's youngest sister Caroline; king of Naples 1808; in 1815, hoping to make himself king of all Italy, declared war on Austria but was defeated; the restored King Ferdinand had him court-martialed and shot.
Muratore (*mü-rä-tôr'*), **Lucien** (1878–1954), French operatic tenor, born Marseilles, France; sang with New York, Chicago, and European opera companies; was married to Lina Cavalieri, Italian operatic soprano, 1914–27.
Murchison, Sir Roderick Impey (1792–1871), British geologist, born Tarradale, Scotland; set up Silurian system; with Adam Sedgwick, named Devonian system ('The Silurian System').
Murchison River, stream in western Australia, flowing s.w. into Indian ocean, *map* A-488
Murcia (*mo̦r'thē-yä*), Spain, industrial center, capital of province of same name in s.e., on river Segura; pop. 218,375, with suburbs; silk industry: *maps* S-312, E-425
Murder, in law. *See also in Index* Law, *table* of legal terms
punishment for P-415
Murdock, William (1754–1839), Scottish engineer, inventor of coal-gas lighting G-30, *picture* I-203
Mu'rex, genus of mollusks that secrete Tyrian purple.
Mur'free, Mary Noailles (1850–1922), novelist, born Murfreesboro, Tenn.; early work published under pen name of Charles Egbert Craddock ('The Prophet of the Great Smoky Mountains' and other stories of Tennessee life).
Murfreesboro, Tenn., city 33 mi. s.e. of Nashville; pop. 13,052; capital of state 1819–26; cotton trade; red cedar market; Middle Tennessee State College: *map* T-66
battle of Murfreesboro, or battle of Stones River C-336, F-283, *map* C-334: Thomas at T-120
Murger (*mür-zhĕr'*), **Henri** (1822–61), French novelist and poet; described life of young students, writers, and artists in Paris; Puccini's opera 'La Bohème' based upon his sketches 'Scènes de la vie de Bohème'.
Muriatic acid. *See in Index* Hydrochloric acid
Murillo (*mū-ril'ō*, Spanish *mu̦-rēl'yō*), **Bartolomé Esteban** (1617–82), Spanish painter M-451–2
'Immaculate Conception', *picture* M-452
paintings in Seville S-109
Murmansk (*mo̦r-mänsk'*), Russia, port and naval station on Arctic Ocean; ice-free year round; center for fishing and mining industry; connected by railroad to Leningrad; pop. 150,000: *maps* R-266, E-417, A-531
Murphy, Charles Francis (1858–1924), political leader, born New York City; Croker's successor as leader of Tammany.
Murphy, Edgar J. (born 1901), physicist, born Luthersville, Ga.; with F. Allison, codiscoverer of virginium (1930) and alabamine (1931).
Murphy, Frank (1890–1949), jurist and political leader, born Harbor Beach, Mich.; mayor of Detroit 1930–33; U.S. high commissioner to Philippines 1935–36; governor of Michigan 1936–39; attorney general of U.S. 1939; associate justice U.S. Supreme Court 1940–49.
Murphy, Isaac (1802–82), public official, born near Pittsburgh, Pa.; Civil War governor of Arkansas: A-371
Murphy, William Parry (born 1892), medical scientist, born Stoughton, Wis.; director Peter Bent Brigham Hospital, Boston, and teacher at Harvard Medical School; shared, with George R. Minot and George H. Whipple, Nobel prize (1934) for discovery of value of raw liver or liver extract in treatment of anemia.
Murphysboro, Ill., industrial city on Big Muddy River, 140 mi. s. of Springfield; pop. 9241; in agricultural, coal and shale region and fruit belt; flour, shoes, wood products: *map* I-37
Murray, (George) Gilbert (Aimé) (born 1866), British classical scholar, best known for translations of plays of Euripides in English verse ('History of Ancient Greek Literature'; 'Rise of the Greek Epic'; 'Five Stages of Greek Religion').
Murray, James (1721–94), British soldier and statesman, born Ballencrief, Scotland; one of Wolfe's brigadiers in siege of Quebec in 1759; 1760 appointed military governor of Quebec; first civil governor of Quebec province, serving 1764–68: C-96
Murray, Sir James Augustus Henry (1837–1915), British lexicographer, born Denholm, Scotland; twice president of Philological Society of London, in connection with which he became editor, 1879, of the 'New English Dictionary' (Oxford Dictionary), which has been called the most exhaustive work of its kind in any language.
Murray, or Moray, James Stuart, earl of (1531?–70), half brother of Mary, queen of Scots, and her protector and chief adviser on her return from France; her chief enemy after her open break with Protestantism, and regent for the infant James after Mary's abdication.
Murray, Sir John (1841–1914), British oceanographer, born Cobourg, Ontario; edited reports of the *Challenger* expedition, and wrote numerous books and papers on scientific subjects.
Murray, Lindley (1745–1826), grammarian, born Dauphin County, Pa.; his 'Grammar of the English Language' was recognized as standard in England and America for 50 years.
Murray, Mary Lindley, heroine in Revolutionary War who in 1776 cleverly delayed British General Howe at her Manhattan mansion, thus saving large company of American army.
Murray, Philip (1886–1952), American labor leader, born Scotland; emigrated to U.S. 1902; coal miner in Pennsylvania; international vice-president United Mine Workers of America 1920–40; member National Industrial Recovery Board 1935; president Congress of Industrial Organizations 1940–52: L-71
Murray, Utah, city 7 mi. s. of Salt Lake City; pop. 9006; smelting of lead ores; diversified farming: *maps* U-416, U-252
Murray Bay, Quebec, Canada. *See in Index* La Malbaie
Murray River, chief river of Australia draining, with Darling tributary, entire s.e. quarter; mouth on s. coast 40 mi. e. of Adelaide: A-479, *maps* A-489, 478
Hume Dam A-484, *picture* A-491
Murray State College, at Murray, Ky.; opened 1923; education, arts and sciences, agriculture, home economics, music; graduate study.
Murre (*mûr*), a guillemot, bird of the auk family A-472*b*
nest and egg, *picture* B-173
scientific name A-473
Murrow, Edward R(oscoe) (born 1908), radio and television news reporter, born Greensboro, N. C.; with Columbia Broadcasting System after 1935, a vice-president 1945–47; winner of various awards including 1952 "Emmy" for best public affairs program on television, 'See It Now'; author of 'This I Believe' (selected scripts from his radio program of the same name).
Murrumbidgee (*mŭr-ŭm-bĭj'ē*) **River**, in s.e. Australia; flows through New South Wales 1350 mi. into Murray River; navigable between June and November for small boats as far inland as Hay: *map* A-489
Murry, J(ohn) Middleton (born 1889), English editor and critic; husband of Katherine Mansfield; literary reviewer *London Times*; editor *Athenaeum*, *Adelphi*; author of many critical studies.
Muruts (*mū'ruts*), a tribe of natives of Borneo, known as able farmers.
Murviedro, Spain. *See in Index* Saguntum
Murzuch, or **Murzuk** (*mo̦r-zŏk'*), a caravan station in Libya; chief town of Fezzan; pop. 680: L-218, *map* A-46
Mus, Publius. *See in Index* Decius Mus
Mus, the mouse and rat genus of rodents M-441
Musa (*mū'za̦*), genus of perennial herbs
banana B-46
Manila hemp H-333
Musaeus (*mū-sē'ŭs*) (5th century B.C.), Greek grammarian and poet
story of Hero and Leander H-349
Mus'ca, a constellation, *chart* S-373, S-375
Musca, insect genus including common flies.
Muscadine (*mŭs'ka̦-dĭn*) **grapes** G-155
Mus'carine, a poison found in certain mushrooms M-457
Muscat', also **Masqat**, seaport and capital of independent state of Oman in e. Arabia; pop. 5,500; chief export, dates; name sometimes given to Oman itself: *maps* A-285, A-407
formerly controlled Zanzibar Z-349
Mus'cat, or **mus'catel**, one of several varieties of musk-flavored grapes, usually light colored; produces largest-sized raisins.
Muscatine', Iowa, industrial and trade center on Mississippi River 25 mi. s.w. of Davenport; pop. 19,041; known for watermelons and sweet potatoes grown on Muscatine Island nearby; sash and doors, canning and preserving: I-220, *maps* I-215, U-253
pearl button center B-370
Musci (*mŭs'ī*), the true mosses, one of the two classes of the phylum of plants, *Bryophyta*.
Muscle M-452–4, *pictures* M-453–4, *color pictures* P-239–40
cerebellum and B-280
chemical changes B-146, R-118
diaphragm D-81

THE GREAT MUSEUMS OF THE WORLD

Art Galleries and Archaeological Collections

United States

Place	Name	Established	Control or Major Support	Noted for
Baltimore	Walters Art Gallery	1931	Endowment	Medieval decorative arts, Egyptian and classical antiquities, ceramics.
Boston	Museum of Fine Arts	1870	Endowment	Oriental, Egyptian, and classical collections.
Buffalo	Albright Art Gallery	1862	City	18th- and 19th-century French and American paintings, contemporary arts.
Cambridge	Peabody Museum	1866	Harvard Univ.	Comprehensive archaeological and ethnological collections, Mayan and American Indian collections particularly strong.
	William Hayes Fogg Art Museum	1895	Harvard Univ.	Classical and Oriental collections, European paintings of 18th and 19th centuries.
Chicago	Art Institute	1879	Endowment	19th- and 20th-century French paintings, Oriental arts, Thorne miniature rooms, contemporary American paintings.
	Oriental Institute	1894	Univ. of Chicago	Near Eastern archaeology.
Cleveland	Museum of Art	1913	Membership	Medieval art, general collections.
Dallas	Museum of Fine Arts	1902	City	Southwestern Americana, contemporary arts.
Denver	Art Museum	1893	City	Indian arts, international folk art, contemporary paintings and sculpture.
Detroit	Institute of Arts	1884	City	Traditional and contemporary European and American *paintings, Rivera industrial murals.*
Hartford	Wadsworth Atheneum	1842	City	European and American paintings, American furniture, costume collections; first public art museum in the United States.
Houston	Museum of Fine Arts	1900	Membership	American Indian arts, general collections.
Kansas City, Mo.	William Rockhill Nelson Gallery of Art	1926	Endowment	European and American paintings, American Indian art.
Los Angeles	County Museum	1911	County	Oriental and classical antiquities, contemporary American art.
New York City	Brooklyn Museum	1889	City	South Pacific and Oriental collections, contemporary arts, children's museum.
	Frick Collection	1920	Endowment	14th- to 19th-century European masterpieces.
	Metropolitan Museum of Art	*1870*	City and membership	Best and most comprehensive general *collections in the* United States.
	Museum of Modern Art	1929	Membership	All aspects of contemporary arts; educational and publication programs have contributed heavily to popularization of contemporary art.
	Museum of Non-objective Painting	1937	Endowment	Guggenheim collection of contemporary abstract paintings.
	Whitney Museum *of American* Art	*1930*	Endowment	*20th-century American paintings and sculpture; housed* with Museum of Modern Art.
Philadelphia	Museum of Art	1875	City and membership	Comprehensive collections of paintings and sculpture, decorative arts; Rodin collection is housed in Rodin Museum.
	Pennsylvania Academy of the Fine Arts	1805	Endowment and membership	American art from the 18th century to date; oldest fine arts school in the United States.
	University Museum	1887	Univ. of Pa.	Near East, Oriental, and African art and archaeological collections.
Pittsburgh	Carnegie Institute	1896	Endowment	General collections of paintings, sculpture, and graphic arts; biennial international exhibition.
St. Louis	City Art Museum	1879	City	Classical and Oriental collections.
San Francisco	M. H. de Young Memorial Museum	1895	City and county	Oriental arts, Western Americana.
	Museum of Art	1921	Membership	Contemporary American, Latin American, and European collections.
San Marino, Calif.	Henry E. Huntington Library and Art Gallery	1919	Endowment	18th-century British paintings, British and French decorative arts.
Santa Fe	Museum of New Mexico	1909	Archaeological Institute of America	American Indian collections, international folk art, Southwestern art and archaeology, Spanish colonial collection.
Seattle	Art Museum	1906	Membership	Oriental collections, regional art of the Northwest.
Toledo	Museum of Art	1901	Membership	General collections, ancient and modern glassware.
Washington, D.C.	Corcoran Gallery of Art	1869	Endowment	American paintings and sculpture.
	Freer Gallery of Art (Smithsonian Institution)	1906	Nation	Far and Near Eastern arts, American paintings, including extensive collection of Whistler.
	Phillips Collection	1918	Endowment	Contemporary arts and their sources.
	National Gallery of Art (Smithsonian Institution)	1937	Nation	Mellon, Kress, and Widener collections of European masterpieces, Dale collection of contemporary European masterpieces on permanent loan, classic American paintings, Index of American Design.

Foreign

Amsterdam	Rijksmuseum	1808	State	The national collection of paintings and the graphic arts.
Antwerp	Royal Museum for Fine Art	1810	State	Important collection of Flemish masters, 19th- and 20th-century Belgian artists, Rodin collection.
Athens	National Archaeological Museum	1874	State	Classical and Egyptian antiquities.
Berlin	State Museum	1830	State	Supervisory body for numerous special museums; antiquities, classical and modern European paintings and sculpture, and folk art.
Brussels	Royal Museum of Fine Arts	1830	State	Medieval, Renaissance, and modern collections in paintings and sculpture.
Buenos Aires	National Museum of Fine Arts	1895	State	Modern European and American collections.
Cairo	Egyptian Museum	1835	State	Egyptian antiquities from prehistoric times to 6th century A.D.

(Continued on the next page)

THE GREAT MUSEUMS OF THE WORLD—*Concluded*

Place	Name	Established	Control or Major Support	Noted for
Florence	Pitti Palace	17th cent.	State	16th- and 17th-century Florentine paintings.
	Uffizi Gallery	16th cent.	State	Strongest collection of Florentine Renaissance paintings.
Hague, The	Royal Picture Gallery	1821	State	Major collections of Dutch and Flemish masterpieces.
London	British Museum	1753	State	Classical antiquities, medieval and Oriental arts.
	National Gallery	1824	State	The national collection of British and European paintings.
	Tate Gallery	1897	State	The modern collection of the National Gallery, 19th- and 20th-century British and European paintings.
	Victoria and Albert Museum	1852	State	Fine and applied arts of all countries.
Madrid	Museum of the Prado	1819	State	Major European collection of masterpieces of classical paintings.
Melbourne	National Gallery of Victoria	1859	State	Classical and contemporary painting collections, Australiana.
Mexico City	National Museum of Anthropology	1825	State	Archaeological and folk art collections representing Mexico and Central America.
Munich	Bavarian State Art Collection	1836	State	Includes several major collections, among them the Alte Pinakothek collection of old masters.
Naples	National Museum	1738	State	Collection of Pompeian antiquities.
New Delhi	Central Asian Antiquities Museum	1929	State	3d- to 9th-centuries Middle East and Oriental antiquities.
Oslo	Norwegian Folk Museum	1894	State	Open-air presentations of elements of Scandinavian culture.
Ottawa	National Gallery of Canada	1880	State	Comprehensive Canadian painting collection, English and European art.
Paris	Cluny Museum	1844	State	Medieval treasures, popular and fine arts.
	Guimet Museum	1882	State	Collections pertaining to the religions and cultures of the Orient.
	Louvre	1793	State	Extensive collections in all arts; the world's most famous art museum.
	Rodin Museum	1916	State	Largest collection of sculpture and drawings by Rodin.
Rome	Borghese Museum	17th cent.	State	Classical and baroque sculpture, gallery of Italian painting masterpieces.
	Capitoline Museum	15th cent.	City	Classical sculpture collection.
	Conservatori Museum	15th cent.	City	Classical sculpture collection.
	National Museum	1889	State	Classical sculpture and bronzes, archaeological collections.
São Paulo	Art Museum	1947	City	Contemporary international collections of paintings and sculpture.
Stockholm	National Museum	1792	State	Collection of Scandinavian paintings and sculpture, classical and contemporary.
Tokyo	National Museum	1932	State	Comprehensive collections of Japanese arts and crafts.
Vatican City	Vatican Museums	—	Holy See	Numerous extensive collections acquired through the centuries by the Vatican, strong in classical paintings and sculpture; Sistine Chapel.
Venice	Gallery of the Academy	1807	State	Collection of Venetian classical masterpieces.
Vienna	Art History Museum	1891	State	Classical sculpture and antiquities, industrial arts, European paintings.

Museums of Science and Industry

United States

Place	Name	Established	Control or Major Support	Noted for
Buffalo	Museum of Science	1929	Membership	Comprehensive collections in the natural sciences.
Chicago	Adler Planetarium and Astronomical Museum	1930	Endowment and city	Comprehensive collection of astronomical instruments.
	Museum of Science and Industry	1926	Endowment	Extensive collections graphically demonstrating the relationships between science and industry.
	Natural History Museum	1893	Endowment	Comprehensive collections in natural sciences, particularly strong in anthropology and zoology.
Dearborn, Mich.	Edison Institute	1929	Endowment	Open-air re-creation of 18th-and 19th-century America and its pioneer industries.
New York City	American Museum of Natural History	1869	Endowment	Major collections in all natural sciences; has pioneered in contemporary museum presentation.
Philadelphia	Academy of Natural Sciences	1812	Endowment	Extensive historical collections in all the natural sciences.
	Franklin Institute	1824	Membership and endowment	Graphic presentation of industrial and scientific collections.
Washington, D.C.	National Museum (Smithsonian Institution)	1846	Nation	Collections in all branches of science and industry.

Foreign

Place	Name	Established	Control or Major Support	Noted for
Antwerp	Plantin-Moretus Museum	1876	City	Printing history and the graphic arts.
Berlin	Natural History Museum	1883	Univ. of Berlin	Major collections in geology, mineralogy, and zoology.
London	British Museum (Natural History)	1753	State	Major collections in all natural sciences. (Established as separate unit 1881.)
	Science Museum	1857	State	Collections in science and technology, major collection relating to inventions.
Munich	State Scientific Collections	1903	State	Controlling body for numerous major natural history collections.
Ottawa	National Museum of Canada	1842	State	General science collections.
Paris	National Museum of Natural History	1626	State	Major collections in all natural sciences.
Rio de Janeiro	National Museum	1818	State	Archaeological, anthropological, and general scientific collections.
Vienna	Natural History Museum	1748	State	Mineralogical, anthropological, and general scientific collections.
	Trade and Industrial Museum	1816	State	Collections in all branches of technology.

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Muscle sense. *See in Index* Kinesthetic sense

Muscle Shoals, Ala., town on Tennessee River; pop. 1937; site of nitrate and munitions plants developed by government after passage of National Defense Act of 1916: *map* A-126
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Wilson Dam A-118, *picture* A-118

Mus'covite, mica M-211, M-266

Mus'covy, until 18th century, name commonly used for European Russia, from its capital, Moscow.

Muscovy, a duck D-162

Muscovy Company, English company formed for trade with Russia and for polar exploration
Hudson's voyages for H-437
Sebastian Cabot founds C-9

Mu'ses, in Greek mythology, goddesses presiding over the arts and sciences M-454

Museum (*mū-zē'ŭm*), a collection of articles arranged and classified for exhibition; also the building in which the collections are kept. The word "museum" in its Greek form meant a temple sacred to the Muses.

Museum of Modern Art, New York City N-225. *See also in Index* Museums, *table*
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Orozco's 'Zapatistas' P-37*a*, *color picture* P-37
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William Rockhill Nelson Gallery of Art, Kansas City, Mo., *picture* U-331

SOME AMERICAN COMPOSERS

(For biographical information, *see in Index* names below)

Antheil, George
Barber, Samuel
Basie, William
Berlin, Irving
Bernstein, Leonard
Bland, James A.
Blitzstein, Marc
Bloch, Ernest
Bond, Carrie Jacobs
Borowski, Felix
Burleigh, Henry (Harry) Thacker
Cadman, Charles Wakefield
Carmichael, Hoagland (Hoagy)
Carpenter, John Alden
Chadwick, George Whitefield
Copland, Aaron
Crosby, Fanny
Damrosch, Walter J.
Dawson, William Levi
DeKoven, Reginald
Dett, Robert Nathaniel
Emmett, Daniel Decatur
Foote, Arthur
Foster, Stephen Collins
Friml, Rudolf
Ganz, Rudolf
Gershwin, George
Godowsky, Leopold
Goldman, Edwin Franko
Goldmark, Rubin
Gottschalk, Louis M.
Grainger, Percy Aldridge
Griffes, Charles Tomlinson
Grofé, Ferde
Gruenberg, Louis
Hanby, Benjamin Russel
Handy, William Christopher
Hanson, Howard
Harris, Roy
Herbert, Victor
Janssen, Werner
Kelley, Edgar Stillman
Kern, Jerome
Key, Francis Scott
Kreisler, Fritz
MacDowell, Edward A.
Nevin, Ethelbert Woodbridge
Paine, John Knowles
Porter, Cole
Powell, John
Romberg, Sigmund
Root, George Frederick
Schuman, William
Sessions, Roger
Siegmeister, Elie
Sousa, John Philip
Sowerby, Leo
Stoessel, Albert
Taylor, Deems
Thomson, Virgil
Waller, Thomas (Fats)
Work, Henry Clay

Musgrave, Sir Anthony (1828–88), British statesman, born Antigua, West Indies; governor of Newfoundland 1864 and of British Columbia 1869–71; helped to bring British Columbia into the Dominion Confederation.

Musgrove, Mary, Indian heroine of Georgia colony G-81

Mushet (*mŭ-shĕt'*), **Robert F.** (1811–91), English metallurgist I-247

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A LIST OF MUSICAL TERMS AND FORMS

A cappella (*ā kăp-pĕl'lā*) Singing, either sacred or secular, by several voices without instrumental accompaniment.
Accelerando (*ăk-sĕl-ĕr-ăn'dō*). Increase the speed; gradually faster.
Accent. Emphasis on certain notes or chords required for the rhythmic performance of a composition. "Artificial" accents, indicated by special signs, demand stress of certain notes or chords not usually accented in a given meter plan.
Acciaccatura (*ăt-chăk-kā-tọ'rā*). A grace note, printed smaller than the main notes and having a light stroke across the stem of the note. It has no duration value and is to be played without emphasis and as quickly as possible.
Accidental. A sharp, flat, double sharp, double flat, or natural, usually signifying a departure from the key signature.
Adagio (*ạ-dä'ḡō*). Slow; 100 to 116 metronome beats to the minute. Also a slow movement in a composition.
Ad libitum (*ădlĭb'ĭ-tŭm*). At the pleasure of the performer.
Agitato (*ä-ḡē-tä'tō*). In an agitated manner.
Allegro (*ä-lā'ḡrō*). Quick, lively; 160 to 184 metronome beats to the minute.
Andante (*ăn-dăn'tā* or *ăn-dăn'tē*). Smooth, flowing, and rather slow in tempo; 116 to 152 metronome beats to the minute.
Andantino (*ăn-dăn-tē'nō*). Quite slow but not so slow as *andante.*
Animoso (*ä-nē-mō'sō*). In a lively and spirited manner; energetic.
Answer. Repetition of a motive or theme by a voice or instrument other than the one which introduced it.
Anticipation. The introduction of a note (or notes) just preceding the chord to which the note belongs.
Appoggiatura (*ä-pŏḡ-ạ-tụr'ạ*). A grace note, printed smaller than the main notes. Unlike the *acciaccatura*, it "steals" duration from the succeeding note.
Aria (*ä'rĭ-ạ* or *ĕr'ĭ'ạ*). Literally an air, or melody; in opera, an important lyric solo with instrumental accompaniment.
Arpeggio (*är-pĕḡ'ō*). A chord, the tones of which are played successively (upward unless otherwise indicated) in a quick and regular manner.
Assai (*äs-sä'ē*). Very, as *allegro assai*, very rapid.
A tempo. In strict conformity to the established time.
Ballet. The music for a dance performed by one or more persons, whose movements are descriptive of an idea or emotion.
Bar. A vertical line on the staff, used to separate measures; the music between two such lines.
Barcarole (*bär'kạ-rōl*). A song of the Venetian gondoliers or an imitation of such a song. It is usually in a smooth, swinging tempo, suggestive of the graceful motion of a small boat.
Berceuse (*bĕr-sûz'*). A cradle song, or lullaby; vocal or instrumental composition, melodious, with a quiet, rhythmic swing.
Cadence (*kā'dĕns*). A succession of chords or notes bringing a composition or one of its sections to its conclusion.
Cantabile (*kän-tä'bē-lā*). Even and continuous like a song.
Cantata (*kăn-tä'tạ*). A short composition for solo voices and chorus, usually setting forth a brief narrative.
Canzonetta. A simple, short song, bright and light in character.
Chord. Three or more tones heard at the same time.
Chromatic. Progressing by half steps. From E to E sharp is a chromatic half step but the same interval expressed as Eto F is termed a diatonic half step.
Coda (*kō'dạ*). A concluding passage; brings composition to a proper ending.
Con brio (*kŏn brē'ō*). With brightness, spiritedly.
Concerto (*kŏn-chĕr'tō* or *kŏn-sûr'to*). A composition usually for a solo instrument and orchestra, corresponding generally in form to the sonata.
Con fuoco (*kŏn fwō'kō*). With fire.
Con sordino (*kŏn sŏr-dē'nō*). With mutes; used in conjunction with string and brass instruments.
Counterpoint. A manner of writing music in which attention is focused on the combination of melodic lines; opposed to harmony, which is concerned with successions of chords. A round is a simple example of counterpoint.
Crescendo (*krĕ-shĕn'dō* or *krĕ-sĕn'dō*). Gradually increase the loudness, or power, of tone.
Da capo (*dä kä'pō*). Repeat from the beginning; abbreviated D.C.
Degree. The step between two consecutive notes in a scale.
Diatonic. Belonging to the whole or half steps of a regular scale. *See* Chromatic for comparison.
Diminuendo (*dĭ-mĭn-ū-ĕn'dō*). Gradually decrease the loudness, or volume.
Dolce (*dōl'chā*). Sweetly, softly, and smoothly.
Dominant. The fifth tone of a scale; also a chord bíult on the fifth tone.
Entr'acte (*än-träkt'*). Music performed between the acts of a play or opera.
Étude (*ā'tūd* or *ā-tūd'*). A study (musical composition) intended for training or testing the performer's technical skill. Études of great beauty were written by Chopin, Debussy, and Liszt.
Fantasia (*făn-tä'zhạ, făn-tạ-zē'ạ*, or *făn-tä'zĭ-ạ*). Generally used to indicate a composition characterized by very free treatment of musical materials.
Finale (*fē-nä'lā*). The last number in an opera or musical comedy, usually sung by soloists and chorus; the concluding part of any musical composition.
Form. Usually refers to the main structure of a piece, as sonata form, fugue form, etc.
Forte (*fôr'tā*). Loud; *mezzoforte*, moderately loud; *fortissimo*, very loud; *fortississimo*, extremely loud. Abbreviations: *f, mf, ff*, and *fff.*
Fugue (*fūḡ*). A contrapuntal composition of two or more melodies (subjects) which imitate and answer each other according to a strict and detailed plan involving key relationships and a one-by-one entry of each voice as the composition begins.
Gavotte. A relatively slow dance in 4-4 time; originated in France.
Grace note. A short note introduced as an ornament and not an essential part of the melody.
Grave (*ḡrä'vā*). Serious, very slow, somewhat heavy in movement.
Harmony. Music based on successions of chords.
Imitation. The restatement of musical ideas in different voices or by different instruments.
Intermezzo (*ĭn-tĕr-mĕd'zō*, or *ĭn-tĕr-mĕt'sō*), or **interlude.** A short piece played between the acts, stanzas, or movements of a longer work. It may be played as a separate composition.
Interval. The distance between any two tones.
Key. The identification of a particular scale and the chords based on it. Compositions in the key of C major, for example, use the C-major scale, which commences on C natural and consists of the white (natural) keys of the piano.
Largo. Slow, stately, 40 to 70 metronome beats to the minute.
Legato (*lā-ḡä'tō* or *lē-ḡä'tō*). In a connected, flowing manner. Opposite of *staccato.*
Lento. Large, broad. Generally somewhat similar in tempo to *largo.* Not so slow as *grave.*
Libretto. The text of an opera or similar composition, also the book containing the text.
Madrigal. A 15th- to 17th-century contrapuntal vocal composition with secular words. The melodic lines are very free and often reflect the meaning of the words.
Major. Literally greater; used of intervals which are greater by a half tone than the corresponding minor, or smaller, intervals; used also of keys and of chords in which such intervals predominate.
Mazurka. A spirited Polish dance in 3-8 or 3-4 time.
Measure. The notes between two bars. The measure represents a unit of rhythm since each measure has but one principal accent.
Melody. A succession of notes forming a tune or air; the leading part in a harmonized composition.
Meno (*mā'nō*). Less, not so much.
Meno mosso (*mā'nō môs'sō*). Literally with less movement, hence slower.
Meter. Generally, the number of beats in a measure and the kind of note that receives one beat, as 3-4 time (3 beats of one quarter note each).
Mezzo (*mĕd'zō*). Literally, half, medium; often used with other words, as *mezzo forte*, moderately loud.
Minor. Literally, smaller; used of an interval which is a half tone smaller than the corresponding major interval, of chords containing such intervals, and of scales in which such intervals predominate.
Minuet (*mĭn-ū-ĕt'*). A musical form in 3-4 time to accompany the small, light steps of a dignified dance, also known by the same name. Often part of a suite.
Moderato (*mŏd-ĕ-rä'tō*). At a moderate tempo.
Modulation. The transition from one key to another within a composition.
Molto (*mōl'tō*). Much, very, as *molto adagio*, very slowly.
Morendo (*mō-rĕn'dō*). Diminishing, dying away.
Motet (*mō-tĕt'*). A vocal composition in contrapuntal style, usually without instrumental accompaniment. Today generally thought of in conjunction with a sacred text.
Motive, or **motif.** A theme, subject, or brief musical phrase recurring frequently in a composition.
Natural. A note especially marked in a composition to nullify a sharp or flat indicated in the key.
Nocturne. A composition, generally for the piano, in a tranquil and dreamlike mood.
Non troppo (*nōn trôp'pō*). Not too much.
Obbligato (*ŏb-lĭ-ḡä'tō*). An accompaniment which is essential to the composition; usually written for a single instrument which supplements the leading part taken by another instrument or voice.
Octave. An interval of eight diatonic degrees.
Opera. A major form of musical drama, with voice and orchestral accompaniment; also the plural of *opus.*
Operetta. A lighter form of opera in which much of the action is expressed by spoken words.
Opus (*ō'pŭs* or *ŏp'ŭs*), plural **opera.** A work, or composition, or a group of compositions.
Oratorio (*ŏr-ạ-tō'rĭ-ō*). A composition similar to an opera but founded on a Biblical theme and usually given without action or scenery.

(Continued on the next page)

A LIST OF MUSICAL TERMS AND FORMS—*Concluded*

Overture (*ō'vẽr-tūr*) An introductory part to an opera or other musical work, a concert overture is an independent composition for band or orchestra

Pesante (*pa-sän'ta*) Heavily, with firmness and emphasis

Phrase. A short passage which is more or less complete in itself and expresses a musical idea or thought

Piano. Soft in tone, *pianissimo*, very soft, *pianississimo*, extremely soft Abbreviations *p pp, ppp*

Più (*pyū*) More, as *più allegro*, more lively or *più mosso*, a little faster

Pizzicato (*pĭt-se-kä'to*) Plucked with the fingers

Polka. A sprightly dance in 2-4 time, originated in Bohemia about 1830

Prelude. An introduction to prepare for succeeding parts of a composition, sometimes applied to independent pieces of a rather informal character

Presto. Rapidly, 184 to 208 metronome beats to the minute

Program music. Instrumental music which is descriptive

Quartet. A group of four performers, a composition in sonata form for four performers

Rallentando (*-räl-ĕn-tăn'do*) Gradually slower

Recitative (*rĕsĭ-ta-tev'*) Musical recitation The term generally implies a freer use of melody and rhythm and is most commonly associated with opera and operetta

Rhapsody (*răp'so-dĭ*) A free type of composition, generally for instruments, often based on folk songs or other national music

Rhythm. An orderly sequence of musical pulsations

Ritardando (*re tar-dăn'do*) Gradually slower

Rondo (*rŏn'do*) A musical form in which one principal theme is repeated two three or more times and alternates with secondary themes

Rubato (*rọ-bä'to*) Literally "robbed"; *the performer is to use some freedom* of rhythm but should not alter the main flow of the composition

Scale. A series of tones proceeding upward or downward according to rules of musical composition

Scherzo (*skĕr'tso*) A tuneful, vivacious movement, often a part of a sonata, concerto, or symphony, generally written in 3-4 time

Score. A printed copy of all the vocal and instrumental parts in a composition, the tones to be sounded simultaneously being placed one above the other

Senza (*sĕn'tsa*) Without

Sforzando (*sfôr-tsan'do*) Special stress, emphasis

Signatures. Symbols indicating the key and the time in which the music is written, the time signature appears on the first staff, the key signature at the beginning of every staff

Smorzando (*zmor-tsan'do*) Becoming slower and softer, fading away

Sonata (*so-nä'ta*) A musical composition of three or four individual movements so related as to form a unified whole

Sonata form. A musical form generally used for the first (*allegro*) movement of a sonata, symphony, concerto, etc It has three main sections *exposition*, in which two (or sometimes more) themes are stated, *development*, in which one or both themes are elaborated and developed, and *recapitulation*, in which both themes are again given in their original form and followed by a concluding coda

Sonatina (*sŏn-a te'na*) A short, somewhat simplified sonata

Sostenuto (*sos-ta-no'to*) Sustained

Staccato (*sta-kä'to*) In a detached, unconnected manner Opposite of *legato*

Staff. The five horizontal, parallel lines and their enclosed four spaces The notes are written on the lines (that is with the line running through the center of the note), or in the spaces, or above or below the staff, with small, extra lines (known as leger lines) being supplied as needed

Subject. A melodic, or musical, phrase on which a composition or a part of a composition is based

Suite. An instrumental composition consisting of a series of related pieces Originally it was developed by combining various dance forms, such as allemande, courante gigue, pavane, and saraband

Symphonic poem. A relatively elaborate work in one movement, of descriptive character

Symphony. A musical composition for orchestra corresponding in form to the sonata

Syncopation. A change in the regular rhythmic pattern by stressing a note that falls on an unaccented beat

Tacet (*ta'sĕt*) Be silent

Tarantella. A very fast and emotional Italian dance in 6-8 time

Tempo. The rate of speed at which a composition is to be performed From the slowest to the fastest tempo, some of the commonest terms are *largo, grave, lento, adagio, andante, moderato, allegro, presto, prestissimo*

Theme. A musical phrase developed with variations and embellishments throughout a composition

Toccata (*to-kä'ta*) Usually a keyboard composition in free form involving rapid, lively passages

Tonic. The first note in any scale, the keynote, or key tone

Triad. A chord of three tones consisting of the root, a third, and a fifth, may be major, minor, diminished, or augmented in form

Triplet. A group of three notes played in the time ordinarily required for two notes of the same length

Virtuoso (*vûr-tu-o'so*) One highly skilled in the playing of an instrument or in singing, sometimes word is used to denote one who excels in technical ability only

Vivace (*ve-va'cha*) Very fast but not as fast as *presto*

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Muske'gon, Mich shipping and manufacturing center on Muskegon Lake between Lake Michigan and Muskegon River, 32 mi n w of Grand Rapids, pop 48,429, airplane automobile, and marine engines billiard and pool tables, knit goods, oil wells and natural gas, all-year steamship service to important lake ports *maps* M-227, U-253

Muskegon Heights, Mich industrial suburb of Muskegon, pop 18,828. *map* M-227

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Muskhog, or **peccary**, a small wild hog of North and South America P-110, *picture* H-404
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Muskin'gum College, at New Concord, Ohio, United Presbyterian, founded 1837, arts and sciences.

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Muskogee (*mŭs-kō'ḡē*), Okla., city in e. near confluence of Arkansas, Grand, and Verdigris rivers; pop. 37,289; poultry processing, canned goods, dairy products, glass products, structural iron and steel fabrication; railroad shops; Oklahoma School for the Blind: O-373, *maps* O-371, U-253
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Musset, Alfred de (1810–57), French dramatist, poet, novelist, and short-story writer; best poetic work found in exquisite love lyrics, 'Les Nuits'.
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Mustapha Kemal, former name of Kemal Atatürk. *See in Index* Kemal Atatürk
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Mutankiang (*mụ'dän'ḡĭ-äng'*), Manchuria, city on Mutan River about 165 mi. s.e. of Pinkiang (Harbin); pop. 200,319; rail and industrial center; sawmilling, pulpmaking and papermaking; machinery manufacturing; soybean pressing, flour milling.
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